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ABSTRACT

This document contains competency profiles in four areas: computer-aided drafting and design; industrial manufacturing technician; mechanical engineering technician; and machine tool, die, and moldmaking technology occupations. The profiles are intended for use in articulating tech prep programs from high school through associate degrees in Ohio. Along with the specific competencies for these occupations, the document contains general competency profiles in these subjects: communications literacy, mathematics literacy, science literacy, technology literacy, computer literacy, technical recording and reporting, teamwork, employability skills, and professionalism that are applicable to all applications. Each competency profile is organized in units and subunits with hundreds of tasks correlated with the grade levels by which they need to be mastered. (KC)

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Tech Prep Competency Profile

Computer Aided Drafting and Design, Industrial Manufacturing Technician, and Mechanical Engineering Technician
and
Machine Tool, Die and Moldmaking Technology

Mid-East Ohio Tech Prep Consortium

March 1996

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Tech Prep Competency Profile

Computer Aided Drafting and Design, Industrial Manufacturing Technician, and Mechanical Engineering Technician and Machine Tool, Die and Moldmaking Technology

Mid-East Ohio Tech Prep Consortium

March 1996

Key:
10 = by end of grade 10
12 = by end of grade 12
AD = by end of the Associate Degree
LL = Lifelong Learning Necessary Due to Technological Change
WS = On-Job Training that Occurs at an Actual Worksite

I = Introduce
R = Reinforce
C = Competent
PS = Physical Science

Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	10	12	AD	LL	WS
Subunit: Reading-Structure					
Exhibit knowledge of language structure*	R	C			
Recognize that there may be more than one interpretation of reading selections	R	C			
Recognize various literary devices	R	C			
Recognize and discuss literary elements	R	C			
Develop and use an increasingly sophisticated vocabulary gained through context*	R	R	R	✓	
Apply knowledge of language structure to reading*	R	R		✓	
Explain why there may be more than one interpretation of reading selections*	R	R		✓	

Unit: Communications Literacy (Ohio's Language Arts Model 9-12) * = Industry identified these to be taught using applied methods Note: The remaining competencies are to be taught using regular or applied methods	10	12	AD	LL	WS
Subunit: Reading-Structure (Cont.)					
Recognize effect of literary devices on meaning	R	R			
Analyze author's use of literary elements	R	R			
Recognize relationship of structure to meaning*	I	R	R		
Describe various interpretations and meaning levels in reading selections	R	R			
Characterize author's use of literary devices	R	C			
Characterize use of literary techniques	R	R			
Critique a variety of literature with regard to plot, dialogue, theme, setting, and characterization	R	C			
Apply an expanding vocabulary gained through reading*	R	R		✓	
Explain various interpretations and meaning levels in reading selections	R	R		✓	
Analyze use of literary techniques (e.g., extended metaphor, simile, personification, hyperbole, pun, alliteration)	R	R		✓	
Understand use of literary devices (e.g., irony, satire, allegory, onomatopoeia)	R	R		✓	
Analyze and synthesize pieces of literature with regard to plot, dialogue, theme, setting, and characterization	R	R			
Subunit: Reading-Meaning Construction					
Demonstrate ability to recognize appropriate pre-reading strategies*	C	R	R	✓	
Describe effectiveness of a reading selection	R	R	R	✓	
Read to clarify personal thinking and knowledge*	R	R	R	✓	
Support interpretations of text by locating and citing specific information*	R	R	R	✓	
Develop personal response to a variety of literary works	R	R	R	✓	

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Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	**10**	**12**	**AD**	**LL**	**WS**
Subunit: Reading-Meaning Construction (Cont'd.)					
Recognize diverse literary interpretations	R	R	R	✓	
Engage in self-selected reading activities*	R	R	R	✓	
Confirm and extend meaning in reading by researching new concepts and facts*	R	R	R	✓	
Self-monitor and apply corrective strategies when communication has been interrupted or lost	R	R	R	✓	
Use features of literary genres to extend meaning	R	R			
Assess effectiveness of a selection read	R	R	R	✓	
Use reading as a possible problem-solving strategy to clarify personal thinking and knowledge*	R	R		✓	
Use knowledge of semantic elements (e.g., figurative language, denotation, connotation, dialect) to clarify meaning when reading*	R	R		✓	
Predict, recognize, interpret, and analyze themes based on familiarity with author's work	R	R			
Compare and contrast literary genres	I	R			
Assess validity and quality of selection read	R	R	C	✓	
Clarify meaning when reading*	R	R	R	✓	
Compare personal reaction to critical assessment of a literary selection	I	R	R		
Assess validity of diverse literary interpretations	I	R		✓	
Use reference books to find, evaluate, and synthesize information*	R	R	C	✓	✓
Identify tone of a literary work	R	C			
Critique validity of diverse literary interpretations		I			
Integrate personal reaction to and critical assessment of a literary selection	R	R			

Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	10	12	AD	LL	WS
Subunit: Reading-Application					
Select and read material for personal enjoyment and information*	R	R	R	✓	
Read a variety of complete, unabridged works*	R	R		✓	
Employ various reading strategies according to purpose*	R	R	R		
Participate in selection of books, materials, and topics for literature study groups	R	R			
Develop and apply knowledge of the interrelationship of concepts*	R	R	R	✓	
Read selections from a variety of styles and format, recognizing that style and format influence meaning	R	R	C		
Extend value of reading, writing, speaking, viewing, and listening by pursuing, through reading, new concepts and interests developed as a result of these activities*	R	R	R	✓	
Read extensively from a particular author's work and explain elements of author's style		I			
Subunit: Reading-Multidisciplinary					
Connect themes and ideas across disciplines through literature .	R	R	R		
Read to facilitate learning across curriculum*	R	R	R		
Read to develop awareness of human rights and freedom	R	R			
Participate actively in a community of learners	R	R	R	✓	
Recognize and explain interaction between literature and various cultural domains (e.g., social, technological, political, economic)	R	R			
Explore and analyze a variety of cultural elements, attitudes, beliefs, and value structures by men and women of many racial, ethnic, and cultural groups	R	R	R	✓	
Value thinking and language of others	R	R	R	✓	

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Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	**10**	**12**	**AD**	**LL**	**WS**
Subunit: Reading-Multidisciplinary (Cont'd.)					
Relate literature to historical period about which or in which it was written	R	R			
Read to facilitate content learning*	R	R	R	✓	
Subunit: Writing-Structure					
Develop and expand a repertoire of organizational strategies (e.g., narration, comparison/contrast, and description) through practice and discussion*	R	R	C		
Clarify word choice according to audience, topic, and purpose*	R	R	C		
Locate and correct errors in usage, spelling, and mechanics using a variety of resources*	R	C			
Recognize information gained from primary and secondary sources*	R	R	C	✓	
Develop writing which contains ordered, related, well-developed paragraphs with sentences of varied lengths and patterns*	R	C		✓	
Use information from a variety of sources to develop an integrated piece of writing	I	R	C	✓	✓
Evaluate and revise writing to focus on such things as audience, tone, and purpose*	I	R	C	✓	✓
Recognize differences between documentation and reference list styles*	R	R	C		
Develop extended pieces of writing which contain ordered, related, well-developed paragraphs with sentences of varied lengths and patterns*	I	R	C	✓	
Select from a repertoire of organizational strategies a pattern appropriate to a topic*	R	R	C		
Synthesize information from a variety of sources*	R	R	R	✓	✓
Refine word choice and tone according to audience, situation, and purpose*	R	R	R	✓	✓
Appropriately cite information gained from primary and secondary sources*	I	R	C	✓	✓

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Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	10	12	AD	LL	WS
Subunit: Writing-Structure (Cont.)					
Use style manuals or software to prepare documentation and reference lists*	I	R	C		
Develop effectively organized pieces of expository writing containing strong voice, clear thesis, and well-developed ideas*	R	R	C	✓	✓
Identify organization patterns appropriate to writing topic*	R	R	C	✓	✓
Respond to others' suggested revisions to a writing piece*	R	C			
Subunit: Writing-Meaning Construction					
Demonstrate knowledge of the recursive nature of the writing process by applying it appropriately to various topics, situations, and audiences*	R	C	✓	✓	✓
Develop criteria for writing evaluation using scoring guides and peer/teacher assistance to clarify meaning	R	R			
Respond to others' suggested revisions to a piece of writing	R	R	R	✓	✓
Use word processing, graphics, and publishing aids to construct meaning in writing*			R		
Engage in self-initiated writing activities*	R	R			
Incorporate personal criteria with generally accepted standards for writing evaluation	R	R			
Evaluate, analyze, and synthesize information for writing*	R	R	R	✓	✓
Evaluate own writing using personal and established scoring criteria	R	C	R	✓	
Assess personal/peer revisions to a writing piece*	R	R	R		
Recognize and refine personal writing styles*	R	R	R	✓	✓
Subunit: Writing-Application					
Apply appropriate writing techniques suitable for varied writing tasks*	R	R	C	✓	

Unit: Communications Literacy (Ohio's Language Arts Model 9-12) * = Industry identified these to be taught using applied methods Note: The remaining competencies are to be taught using regular or applied methods	10	12	AD	LL	WS
Subunit: Writing-Application (Cont'd.)					
Use sentence-combining techniques to improve syntactic fluency and maturity*	R	R	C		
Write in response to prompted and self-selected topics in practical, persuasive, descriptive, narrative, and expository domains*	R	R	R		
Develop personal voice in writing*	R	R	R	✓	✓
Consider audience and purpose for writing*	I	R	C	✓	✓
Develop criteria for selection and potential development of topic*	I	R	C		
Write in journal or learning log to clarify personal thinking and knowledge*	R	R	R	✓	✓
Apply an expanding vocabulary gained through writing*	R	R	R	✓	✓
Make judicious use of reference sources (e.g., dictionary, thesaurus, on-line data base, encyclopedia)*	R	R	C	✓	✓
Demonstrate an appreciation for aesthetically pleasing language through word choice and style*	R	R	R	✓	✓
Apply revising and editing strategies needed for writing task*	R	R	R	✓	✓
Vary sentence lengths and patterns*	R	R	R	✓	✓
Refine personal voice in writing	R	R	R	✓	✓
Vary styles and formats for intended purpose and audience	R	R	C		
Apply criteria for selection and development of topic	R	R	C		
Participate in peer review of writing in progress	R	R	R		
Use transitions between sentences, ideas, and paragraphs in writing*	I	R	C	✓	
Revise and edit papers extensively in preparation for presentation/publication*	R	R	C	✓	✓
Develop a variety of genres	R	R			
Focus writing and tone on such elements as audience, situation, and purpose*	I	R	C	✓	
Develop topic fully and appropriately*	R	C	R	✓	

Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	**10**	**12**	**AD**	**LL**	**WS**
Subunit: Writing-Application (Cont.)					
Use writing process to clarify personal thinking and knowledge	**R**	**R**	**R**	✓	✓
Apply appropriate recursive writing process as suggested by writing tasks and writer's process	**R**	**R**	**R**		
Develop an extended piece of writing*	**R**	**R**	**C**		
Revise writing and tone to assure focus on such elements as audience, situation, and purpose*	**R**	**R**	**C**	✓	✓
Use writing process to write reflectively	**R**	**R**			
Subunit: Writing-Multidisciplinary					
Use writing process for learning across curriculum	**R**	**R**	**R**		
Use writing process to demonstrate knowledge of need for human rights and freedom	**R**	**R**			
Value and apply collaborative skills in writing process	**R**	**R**	**R**	✓	✓
Write in response to reading, speaking, viewing, and listening*	**R**	**C**	**R**	✓	
Use multidisciplinary resources in writing projects	**R**	**R**	**R**		
Use writing process to facilitate learning across curriculum	**R**	**R**	**R**		
Recognize value of and engage in collaboration in writing process	**R**	**R**	**C**		
Use communication processes to develop a published writing piece in collaboration with others	**R**	**R**	**R**		
Record experiences and observations related to content learning	**R**	**R**	**C**		
Apply collaborative skills in writing process	**R**	**R**	**R**		
Write collaboratively with peers	**R**	**R**	**R**		
Use cross-disciplinary resources in writing projects	**R**	**R**	**R**		

Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	10	12	AD	LL	WS
Subunit: Listening/Visual Literacy-Structure	▨	▨	▨	▨	▨
Listen to and view a wide variety of genres	R	R		✓	
Become aware of an author's style through listening and viewing a variety of works	R	R			
Recognize correct and appropriate grammar, diction, and syntax*	R	C	R	✓	
Expand vocabulary through listening to and viewing varied media*	R	R	R	✓	✓
Recognize beauty of language	R	R	R		
Enhance recognition of an author's style through listening and viewing a variety of works	R	R			
Recognize use and misuse of language in media*	R	R	R	✓	
Refine knowledge of style through listening and viewing multiple works by the same author	R	R			
Expand and refine grammar, diction, and syntax through listening*	R	R	R	✓	✓
Compare author's styles through viewing and listening to their works	R	R			
Expand knowledge of complex grammar, diction, and syntax issues	I	R	R		
Subunit: Listening/Visual Literacy-Meaning Construction	▨	▨	▨	▨	▨
Develop critical thinking skills necessary to evaluate media and assess oral presentations*	R	C		✓	✓
Compare new oral texts to past experiences and knowledge in order to enhance comprehension	I	R			
Recognize how rhythmic patterns, silence, and cadence enhance quality of speech and literature	R	R			
Focus listening and viewing on themes and/or plots	I	R		✓	
Gather information from listening and viewing experiences to enhance research*	R	R	R	✓	✓

Unit: Science Literacy (Ohio's DRAFT Science Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	**10**	**12**	**AD**	**LL**	**WS**
Subunit: Listening/Visual Literacy-Meaning Construction (Cont'd.)					
Use critical thinking skills to evaluate media and oral presentations*	R	C		✓	✓
Use prior knowledge and experiences to facilitate comprehension of new oral texts	R	R			
Identify rhythmic and time patterns in speech and literature	R	R			
Identify and analyze themes and/or plots when listening and viewing	R	R			
Use information gathered from listening and viewing experiences to expand research*	R	R	R		
Enhance use of critical thinking skills to evaluate media and oral presentations	R	R			
Consider prior knowledge and experiences when attempting to understand the meaning of new texts	R	R			
Appreciate rhythmic and time patterns of speech and literature	R	R			
Select viewing and listening materials to support written text*	R	R			
Evaluate media and oral presentations analytically and critically	R	R	R		
Organize prior knowledge and experiences to comprehend new texts*	R	R	C		
Organize and use viewing and listening materials to support written text*	R	R			
Subunit: Listening/Visual Literacy-Application					
Listen attentively during oral reading*	C	R	R		
Use media as stimuli for learning and thinking	R	R	R		
Develop knowledge of structure through art, music, and literature	R	R			
Use electronic media to enhance and highlight language learning	R	R	R		
Listen and view for entertainment and enjoyment	C			✓	

Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	10	12	AD	LL	WS
Subunit: Listening/Visual Literacy-Application (Cont'd.)					
Use technology and other media as means of expressing ideas*	R	R	R	✓	
Subunit: Listening/Visual Literacy-Multidisciplinary					
Facilitate learning across the curriculum through critical listening and viewing*	R	R	R		
Engage in individual, small-group, and whole-group listening and viewing activities	R	R	R		
Develop language arts (e.g., viewing, listening) projects collaboratively	R	R	R		
Investigate language and cultural differences through listening and viewing activities	R	R			
Participate in a community of learners through productive listening	R	R			
Subunit: Oral Communication-Structure					
Refine oral communication skills*	R	R	C	✓	✓
Demonstrate knowledge of grammar, usage, and syntax when presenting*	R	R	C	✓	✓
Select topics and vocabulary suitable to audience*	R	C		✓	
Organize notes and ideas for speaking*	R	R	C		
Use language imaginatively*	R	R		✓	
Modulate voice to meaning when interpreting literature orally*	R	R	C		
Organize notes and ideas for formal, semiformal, and informal presentations of information*	R	C		✓	✓
Refine speaking techniques for formal, semiformal, and informal settings*	R	C		✓	✓
Develop repertoire of organizational strategies for presenting information orally*	R	R	C		
Expand vocabulary to fit topic*	R	R	R	✓	✓
Select topics suitable to audience, situation, and purpose*	R	R	C		

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Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	**10**	**12**	**AD**	**LL**	**WS**
Subunit: Oral Communication-Structure (Cont.)					
Select appropriate strategies when organizing notes and ideas for speaking*	R	R	R	✓	✓
Subunit: Oral Communication-Meaning Construction					
Make connections between prior knowledge and new information for oral presentations*	R	R			
Participate in informal speaking activities*	R	R			
Use interviewing techniques to gather information*		I	R	✓	✓
Communicate orally to entertain and to inform	R	R	R	✓	✓
Participate in group communication activities*	R	R	R	✓	✓
Take and organize notes when preparing speech/presentation*	R	C	R	✓	✓
Interpret texts orally to illustrate meaning*	R	R	C		
Respond to needs of various audiences*		I	R	✓	✓
Gather and assess information for speaking*	R	C	R	✓	✓
Communicate orally to inform and persuade*	R	R	C	✓	✓
Prepare and deliver formal speech/presentation*		R	C		
Participate in a variety of oral interpretations*	R	R	C		
Assess needs of audience and adjust language and presentation according to their knowledge*			I	✓	✓
Analyze and synthesize information for speaking*	R	R	C		
Describe effectiveness of literary selection	R	R			
Describe topic or idea in order to clarify personal/audience thinking*	R	C			

Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	10	12	AD	LL	WS
Subunit: Oral Communication-Meaning Construction (Cont.)					
Analyze and synthesize information gathered from a variety of sources for speaking	R	R			
Describe validity and/or quality of a literary selection and justify selection	R	R			
Interpret orally a variety of literature	R	R			
Describe topic or idea to clarify meaning for others*	R	C			✓
Subunit: Oral Communication-Application					
Become proficient at using interviewing techniques*		I	R	✓	✓
Give an oral interpretation for a specific audience		I	R		
Develop and apply oral communication skills for cooperative/collaborative learning*	R	R	R	✓	✓
Use oral communication for a variety of purposes and audiences (e.g., negotiations, book reviews, rationales)*	R	R	R	✓	✓
Develop and apply decision-making strategies*	R	R	R	✓	✓
Practice interviewing techniques*		I	R	✓	✓
Apply interviewing techniques to purposeful interviews*		R		✓	
Focus oral interpretation on a specific audience*		I	R		
Subunit: Oral Communication-Multidisciplinary					
Value thinking and language of others	R	R	R	✓	✓
Develop oral projects collaboratively	I	R	R	✓	✓
Be involved in individual, small-group, and whole-group language activities	R	R	R	✓	✓
Participate actively in a community of learners	R	R	R	✓	✓
Investigate language and cultural differences through oral language activities	R	R	R	✓	✓

Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	**10**	**12**	**AD**	**LL**	**WS**
Subunit: Numbers and Number Relations					
Compare, order, and determine equivalence of real numbers*	C	R			
Estimate answers, compute, and solve problems involving real numbers*	C	R			
Utilize real number system, rational number system, and whole number system*	C	R			
Extend knowledge to complex number system and develop facility with its operation*		I	R		
Subunit: Measurement					
Estimate and use measurements*	C	R			
Understand need for measurement and probability that any measurement is accurate to some designated specification*	C	R			
Understand and apply measurements related to power and work* **(PS)**		I	C		
Understand and apply measurement concepts of distance-rate-time problems and acceleration problems* **(PS)**		I	C		
Use real experiments to investigate elasticity, heat, sound, electricity, magnetism, light, acceleration, velocity, energy, and gravity* **(PS)**			I		
Use real-world problem situations involving mass and weight* **(PS)**		I	C		
Use real-world problem situations involving simple harmonic motion* **(PS)**			I		
Establish ratios with and without common units*	C	R			
Construct and interpret maps, tables, charts, and graphs as they relate to real-world mathematics*	R	C			

Unit: Mathematics Literacy (Ohio's Mathematics Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	**10**	**12**	**AD**	**LL**	**WS**
Subunit: Measurement (Cont'd.)					
Understand and solve rate-change problems* **(PS)**		**C**			
Understand and solve right triangle relationships as they relate to measurement, specifically to Pythagorean theorem*	**C**				
Graph and interpret ordered pairs*	**C**	**R**			
Compute total sales from a variety of items*	**C**				
Comprehend, compute, and interpret real problems involving annuities*			**I**		✓
Develop an ability to identify real problems and provide possible solutions*	**R**	**R**	**R**		
Express and apply different types of measurement scales*	**I**	**C**			
Identify area and volume*	**C**	**R**			
Subunit: Estimation and Mental Computation					
Use estimation to eliminate choices in multiple-choice tests	**R**	**R**			
Use estimation to determine reasonableness of problem situations in a wide variety of applications*	**C**	**R**			
Estimate shape of graphs of various functions and algebraic expressions*	**I**	**R**			
Use mental computation when computers and calculators are inappropriate*	**C**	**R**		✓	
Subunit: Data Analysis and Probability					
Organize data into tables, charts, and graphs*	**C**	**R**			
Understand and apply measures of central tendency, variability, and correlations*			**C**		

Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	**10**	**12**	**AD**	**LL**	**WS**
Subunit: Data Analysis and Probability (Cont'd.)					
Use curve fitting to predict from data*			C		
Use experimental or theoretical probability, as appropriate, to represent and solve problems involving uncertainty*			C		
Use computer simulations and random number generators to estimate probabilities*			C		
Test hypotheses using appropriate statistics*			C		
Read, interpret, and use tables, charts, and graphs to identify patterns, note trends, draw conclusions, and make predictions*	C	R			
Identify probabilities of events involving unbiased objects	R	R	R		
Use sampling and recognize its role in statistical claims*			C		
Design a statistical experiment to study problem, conduct experiment, and interpret and communicate outcomes*		I	C		
Describe normal curve in general terms and use its properties*			C		
Create and interpret discrete probability distributions*			C		
Understand concept of random variable*		I	C		
Apply concept of random variable to generate and interpret probability distributions, including binomial, uniform, and chi square		I	C		
Subunit: Algebra					
Describe problem situations by using and relating numerical, symbolic, and graphical representations*	C	R		✓	

Unit: Science Literacy (Ohio's DRAFT Science Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	10	12	AD	LL	WS
Subunit: Algebra (Cont'd.)					
Use language and notation of functions in symbolic and graphing setting*	I	C			
Recognize and use equivalent zeros of a function, roots and the solution of an equation in terms of graphical and symbolic representations*	I	C			
Describe and use logic of equivalence in working with equations, inequalities, and functions*	C	R			
Develop graphical techniques of solution for problem situations involving functions*	I	C			
Explore and describe characterizing features of functions*	I	C			
Make arguments and proofs in algebraic settings*	I	R			
Factor difference of two squares*	I	C			
Identify slope, midpoint, and distance*	C	R			
Explore and combine rational functions*	I	C			
Explore factoring techniques*	C	R			
Solve quadratic equations by factoring and formula*	I	C			
Set up and solve linear equations*	C	R			
Solve systems of linear equations with two variables*	C	R			
Describe geometric situations and phenomena using variables, equations, and functions*	I	R			
Describe measures of central tendency, mean, median, mode, and variance algebraically and graphically*	I	R			
Represent inequalities on number line and in coordinate plane*	I	C			

Unit: Science Literacy (Ohio's DRAFT Science Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	10	12	AD	LL	WS
Subunit: Algebra (Cont'd.)					
Use coordinate arguments in making geometric proofs*		I	C		
Symbolize transformations of figures and graphs*		I	C		
Explore geometric basis for functions of trigonometry*	C				
Graph linear functions*	C	R			
Develop and use vectors to represent direction and magnitude including operations* **(PS)**			I		
Use polar and parametric equations to describe, graph, and solve problem situations*			C		
Represent sequences and series as functions both algebraically and graphically*		I			
Describe and solve algebraic situations with matrices*		I	R		
Analyze and describe errors and error sources that can be made when using computers and calculators to solve problems*	I	R			
Decide whether problem situation is best solved using computer, calculator, paper and pencil, or mental arithmetic/estimation techniques*	R	R	R		
Explore relationship between complex numbers and vectors*			C		
Examine complex numbers as zeros of functions		I	R		
Translate verbal statements into symbolic language*	C	R			
Simplify algebraic expressions*	C	R			
Use laws and exponents (including scientific notation)*	I	C			

Unit: Science Literacy (Ohio's DRAFT Science Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	10	12	AD	LL	WS
Subunit: Algebra (Cont'd.)					
Expand and extend idea of vectors and linear algebra to higher dimensional situations			I		
Use the ideas of independent basis elements for a vector space and associated fundamental concepts of finite dimensional linear algebra			I		
Develop and use polar and parametric equations to represent problem situations			C		
Explore proofs by mathematical induction	I	R	R		
Subunit: Geometry					
Create and interpret drawings of three-dimensional objects*	C				
Represent problem situations with geometric models and apply properties of figures*	C				
Apply Pythagorean theorem*	C				
Demonstrate knowledge of angles and parallel and perpendicular lines*	C				
Explore inductive and deductive reasoning through applications to various subject areas*	I	R	R		
Translate between synthetic and coordinate representations			I		
Identify congruent and similar figures using transformation with computer programs*			C		
Deduce properties of figures using transformation and coordinates*			C		
Use deductive reasoning*	I	R	R		
Explore compass and straightedge constructions in context of geometric theorems*	C				
Demonstrate knowledge of and ability to use proof*	C				

Unit: Science Literacy (Ohio's DRAFT Science Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	**10**	**12**	**AD**	**LL**	**WS**
Subunit: Geometry (Cont.)					
Use variety of proof techniques (e.g., synthetic, transformational, and coordinate)*	I	R			
Use variety of proof formats, including T-proof (i.e., two-column) and paragraph proof	C	R			
Explore different proof strategies*	C				
Investigate different proofs of theorems*	C				
Develop knowledge of an axiomatic system	C				
Apply transformations and coordinates in problem solving*	I	R			
Deduce properties of figures using vectors			C		
Subunit: Patterns, Relations, and Functions					
Model real-world phenomena with polynomial and exponential functions*	I	R	C		
Explore relationship between zeros and intercepts of functions*	I	R	C		
Translate among tables, algebraic expressions, and graphs of functions*	C				
Use graphing calculator or computer to generate graph of a function*	C				
Explore relationship between a linear function and its inverse*		I	R		
Describe and use characteristics of polynomial functions in problem-solving situations*	I	R	C		
Explore conic sections and graph using graphing calculator or computer		I	R		
Apply trigonometric functions to problem situations involving triangles*	C				

Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	**10**	**12**	**AD**	**LL**	**WS**
Subunit: Patterns, Relations, and Functions (Cont'd.)					
Discover relationship between algebraic description, kind, and properties of conic		I	R		
Explore periodic real-world phenomena using sine and cosine functions*			I		
Analyze effects of parameter changes on graphs*	I	C			
Understand connections between trigonometric and circular functions		I			
Use circular functions to model periodic real-world functions		I			
Solve trigonometric equations and verify trigonometric identities*		I			
Understand connections between trigonometric, exponential, and logarithmic functions and polar coordinates, complex numbers, and series		I			
Model real-world phenomena with a variety of functions*		I	C		
Graph using polar coordinates*			I		
Explore graphs in three dimensions*		I	C		
Explore functions of several variables*			I		
Explore recursive functions using spreadsheets and/or programming languages			I		

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Unit: Science Literacy (Ohio's DRAFT Science Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	10	12	AD	LL	WS
Subunit: Scientific Inquiry					
Check the appropriateness and accuracy of measures and computations using various strategies (e.g., estimations, unit analysis, determination of significant figures	I	C	R		
Use ratios, proportions, and probabilities in appropriate problem situations	R	C	R		
Translate information from and represent information in various forms with equal ease (e.g., tables, charts, graphs, diagrams, geometric figures)	R	C	R		
Use existing algebraic formulas and create new ones in appropriate problem-solving situations	I	R	C		
Estimate and justify probabilities of outcomes of familiar situations based on experimentation and other strategies	I	R	C		
Invent apparatus and mechanical tools needed to perform unique tasks in various situations	I	R	C		
Identify, compare, and contrast different modes of inquiry, habits of mind, and attitudes and dispositions	I	R	R		
Design investigations that are safe and ethical (i.e., obtain consent and inform others of potential outcomes, risks and benefits, and show evidence of concern for human health and safety, concern for non-human species)	I	R	R		
Make and read scale drawings, maps, models, and other representations to aid planning and understanding	I	C	R		
Seek elaboration and justification of data and ideas, and reflect on alternative interpretations of the information	I	R	R		

Unit: Science Literacy (Ohio's DRAFT Science Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	**10**	**12**	**AD**	**LL**	**WS**
Subunit: Scientific Inquiry (Cont.)					
Utilize appropriate units for counts and measures	R	C	R		
Create and use databases (electronic and other) to collect, organize, and verify data and observations	I	R	C		
Design and conduct investigations with multiple variables	R	R	R		
Communicate the results of investigations clearly in a variety of situations	R	C	R		
Examine relationships in nature, offer alternative explanations for the observations, and collect evidence that can be used to help judge among explanations	R	R	R		
Trace the development (e.g., history, controversy, and ramifications) of various theories, focusing on supporting evidence and modification with new evidence	R	R	R		
Select, invent, and use tools, including analog and digital instruments, to make and record direct measurements	I	R	R		
Observe and document events and characteristics of complex systems	R	C	R		
Explain the influences of perspective (e.g., spatial, temporal, and social) on observation and subsequent interpretations		I	R		
Create multiple representations of the same data using a variety of symbols, descriptive languages, mathematical concepts, and graphic techniques)	I	R	C		
Generate testable hypotheses for observations of complex systems and interactions	I	R	R		

Unit: Mathematics Literacy (Ohio's Mathematics Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	**10**	**12**	**AD**	**LL**	**WS**
Subunit: Scientific Inquiry (Cont.)					
Document potentially hazardous conditions and associated risks in selected homes and public areas	R	R	R		
Participate in public debates, relying on documented and verified data to construct and represent a position on scientific issues		I	R		
Construct and test models of physical, biological, social, and geological systems		I	R		
Read, verify, debate, and where necessary, refute research published in popular or technical journals of science (e.g., Discover, Omni, Popular Mechanics)		I	R		
Explore discrepant events and develop and test explanations of what was observed	R	R	R		
Conduct theory-based research using surveys, observational instruments, and other methods	R	R	C		
Modify personal opinions, interpretations, explanations, and conclusions based on new information	R	R	R		
Analyze error and develop explanations in various domains	I	R	C		
Formulate taxonomic schemes based upon multivariate models that help to explain similarities and differences in form, distribution, behavior, survival, and origin of objects and organisms	I	C	R		
Demonstrate various logical connections between related concepts (e.g., entropy, conservation of energy)	I	R	C		
Account for discrepancies between theories and observations	I	R	C		

Unit: Mathematics Literacy (Ohio's Mathematics Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	**10**	**12**	**AD**	**LL**	**WS**
Subunit: Scientific Inquiry (Cont.)					
Analyze the changes within a system when inputs, outputs, and interactions are altered	I	R	C		
Create, standardize, and document procedures	I	C	R		
Determine the sources of significant disparities between the predicted and recorded results and change research procedures to minimize disparities	I	R	C		
Research, locate, and propose applications for abstract patterns (e.g., fractals, Fibonacci sequences, string theory, orbitals)			I		
Recognize and utilize classification systems for particles, elements, compound, phenomena, organisms, and others for exploring and predicting properties and behaviors	I	R	C		
Suggest and defend alternative experimental designs and data explanations (e.g., sampling, controls, safeguards)		I	R		
Recognize and communicate differences between questions that can be investigated in a scientific way and those that rely on other ways of knowing	I	C	R		
Draw conclusions based on the relationships among data analysis, experimental design, and possible models and theories	I	C	R		
Suggest new questions as a result of reflection on and discussions about their own scientific investigations	I	C	R		
Investigate, assess, and comment on strengths and weaknesses of the descriptive and predictive powers of science	I	R	C		

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Unit: Mathematics Literacy (Ohio's Mathematics Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	10	12	AD	LL	WS
Subunit: Scientific Inquiry (Cont.)					
Create new information from representations of data in a variety of forms (e.g., symbols, descriptive languages, graphic formats) utilizing a variety of techniques (e.g., interpolations, extrapolations, linear regressions, central tendencies, correlations)		I	R		
Subunit: Scientific Knowledge					
Investigate various types of dynamic equilibrium (e.g., biological, geological, mechanical, chemical)		I	C		
Investigate the relationship between the rates of energy exchange and the relative energy level of components with systems (e.g., trophic levels of ecosystems, osmosis, rate of heating and cooling, storms)	I	R	C		
Investigate patterns in the natural world (e.g., heredity, crystalline structures, population and resource distributions, diffraction, dispersion, polarization)	I	R	C		
Investigate models and theories that help to explain the interactions of components in systems (e.g., conservation of mass, energy, and momentum; foodwebs; natural selection; entropy; plate tectonics; chaos; relativity; social-psychology)	I	R	C		
Investigate degrees of kinship among organisms and groups of organisms	R				
Investigate the limits of the definition of life, and investigate organisms and physical systems that exist at or near these	I	R	R		
Investigate estimates and measurements of a wide range of distances and rates of change	I	R	C		

Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	**10**	**12**	**AD**	**LL**	**WS**
Subunit: Scientific Knowledge (Cont.)					
Investigate the historical development of theories of change over time (e.g., natural selection, continental drift, the big bang, geologic change)	I	R	R		
Investigate physical and chemical changes in living and non-living systems (e.g., photosynthesis, weathering processes, glaciation, thermal effects of materials, energy cells)	I	C	R		
Investigate simulations of nuclear change (e.g., radioactivity, half life, carbon dating)	I	R	R		
Investigate conservation principles associated with physical, chemical, and nuclear changes	I	R	R		
Formulate descriptions of the impacts of various forms of mechanical and electromagnetic waves on various organisms on each other over time	I	R	C		
Formulate models and hypotheses for patterns in the natural world (e.g., earth structures, transportation systems, migrations, communications, constellations)	I	R	C		
Formulate explanations for the influence of objects and organisms on each other over time	R	C	R		
Formulate and interpret explanations for change phenomena (e.g., mass extinctions, stellar evolution, punctuated equilibrium, molecular synthesis)	I	R	R		
Formulate and interpret explanations for the magnitudes of diversity at different periods of geologic time (e.g., mutation, global cataclysms, continental drift, competition, mass extinctions)	I	R	R		

Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	**10**	**12**	**AD**	**LL**	**WS**
Subunit: Scientific Knowledge (Cont.)					
Formulate interpretations of the structure, function, and diversity in a variety of organisms and physical systems (e.g., DNA and RNA variants, nucleons, interaction particles)	I	R	R		
Formulate understandings of geologic time (e.g., millennia, periods, epochs)	R	C	R		
Formulate an understanding of the historical development of the model of the universe	I	R	R		
Formulate explanations and representations of the production, transmission, and conservation of energy in biological and physical systems (e.g., weather, volcanism, earthquakes, electricity, magnetism, cellular respiration)	I	R	C		
Formulate models and hypotheses about patterns in the natural world (e.g., social behavior, molecular structure, energy transformation, entropy, randomness, aging, chaos, hormonal cycles)	I	R	R		
Formulate interpretations of the relationship between energy exchange and the interfaces between components within systems	I	C	R		
Formulate estimations for the range of energies within and between various phenomena (e.g., thermal electromagnetic, thermonuclear, chemical, electrical)	I	R	C		
Formulate explanations for the historical development of descriptions of matter and energy (e.g., classical Newtonian mechanics, special and general relativity, chaos)	I	C	R		

Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	10	12	AD	LL	WS
Subunit: Scientific Knowledge (Cont.)					
Formulate models that can be used to describe fundamental molecular interactions in living and non-living systems (e.g., cell membranes, semiconductors)	I	R	C		
Formulate an understanding of the degree of relationship among organisms and objects based on molecular structure (e.g., proteins, nucleic acids)	I				
Formulate hypotheses and models that may account for observable events (e.g., electricity and magnetism, gravitation, atoms, bonding, chemical reactions, quantum effects, energy flow on biological systems, predator-prey relationships)	I	R	C		
Formulate models and hypotheses about change over time (e.g., natural selection, speciation, punctuated equilibrium, phyleytic gradualism, stellar evolution, plate tectonics, radioactive decay, quantum mechanical theory)	I	R	C		
Formulate lists of limitations and purpose refinements of standard classification systems (e.g., periodic table, IUPAC, Linnean, standard model)	I	R	C		
Formulate specific cases of limitations and possible exceptions of theories and principles regarding the interactions of moving objects and organisms (e.g., fluid flow in vessels, motion near the speed of light, Heisenberg uncertainty principle, meteorological prediction, local variation and diversity, predicting earthquakes, energy transport in cellular respiration)	I	R			

Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	**10**	**12**	**AD**	**LL**	**WS**
Subunit: Scientific Knowledge (Cont.)					
Formulate plans and contingencies that can be used to accommodate for changes to and stresses on systems (e.g., wildlife and habitat management, corrosion prevention, noise abatement, structure design)	I	R	C		
Formulate models of molecular, atomic, ionic, and subatomic structures and the physical and biological implications of these structures (e.g., genes, nucleons, quarks)	I	C	R		
Formulate estimates for a wide range of measurements and scales (e.g., angstroms to light years)	I	C	R		
Formulate and interpret representations of time from origin to present accounting for phenomena of scale (e.g, smoothness, punctuations, chaos)	I	R	R		
Formulate interpretations of the historical development of various theories of possible causes of diversity among physical and biological phenomena (e.g., the works of Aristotle, Mendel, Darwin, McClintock)	R				
Formulate models and hypotheses that can be used to explain the interactions of components within technological and ecological systems	I	R	C		
Subunit: Conditions for Learning Science					
Participate actively in dialogue about and resolutions of community issues	R	R	R		

Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	10	12	AD	LL	WS
Subunit: Conditions for Learning Science (Cont.)					
Analyze the scientific ideas presented in science fiction stories and films	I				
Perform and repeat investigations to verify data, determine regularity, and reduce the impact of experimental error	I	C	R		
Present the results of investigations in a variety of forums	I	C	R		
Contribute to the decisions regarding topics for investigation	I				
Use various creative means to communicate interpretations of scientific ideas, concepts, phenomena, and events	I	R	C		
Consider the scientific thinking and language of others	I				
Individually and collaboratively produce clearly written representations of investigative results	I	C	R		
Fulfill responsibilities as part of a research group	R	C	R		
Select and utilize resources by various criteria (e.g., efficiency, effectiveness, health, safety) that are appropriate to the investigations being conducted by groups	I	R	C		
Present persuasive argument based on the scientific aspects of controversial issues	I	R	C		
Collect, store, retrieve and manipulate information with available technologies alleges that may range from hand processes up through computer applications	I	R	C		

Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	**10**	**12**	**AD**	**LL**	**WS**
Subunit: Conditions for Learning Science (Cont.)					
Investigate social issues with a scientific perspective (e.g., human rights, wellness, economics, futurism, environmental ethics)	I	R	R		
Keep journals of observations and inferences made over an extended period of time and reflecting upon the impact of these recorded ideas on their thinking and actions	I	R	C		
Examine the intellect, perspectives, and ethics of notable scientists	R	R	R		
Collect and analyze observations made over extended periods of time and compare these to scientific theories	I	C	R		
Create presentations of scientific understandings using diverse modes of expressions	I	R	C		
Wonder about the likelihood of events that may occur by chance or coincidence	R				
Analyze the historical context which leads to and has lead to scientific theories	I	R			
Seek information on topics of personal scientific interest from a variety of sources	I	R	R		
Conduct learner-developed investigations independently and collaboratively over periods of week and months		I	R		
Listen attentively and critically to presentations of scientific information made by others	I	R	R		
Conduct analyses of propaganda related to scientific issues	I				
Perform investigations that require observations over varying periods of time	R	C	R		

Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	**10**	**12**	**AD**	**LL**	**WS**
Subunit: Conditions for Learning Science (Cont.)					
Experience scientific concepts as interpreted by other cultures through multimedia and local and global specialists	I				
Access appropriate technology to perform complicated, time-consuming tasks	I	R	C		
Relate historical accounts of science to the cultural context in which they were written	R				
Work as a contributing member of a collaborative research group	R	C	R		
Examine the influences of social and political structures and realities that contribute to inquiry about scientific issues		I			
Use technology (e.g., desktop publishing, teleconferencing, networking) to communicate scientific ideas	I	C	R		
Explore and analyze a variety of perspectives on science (e.g., works by men and women of many racial, ethnic, and cultural groups)		I			
Lead groups of learners of various ages in designing, planning, and conducting science activities	I	R	C		
Respect the scientific thinking of others and self	I	R	R		
Recognize and contrast different epistemologies		I			
Develop possible courses of action in response to scientific issues of local and global concern	I	R	R		
Determine the validity of research conclusions in relation to the design, performance, and results	I	R	C		

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Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	10	12	AD	LL	WS
Subunit: Conditions for Learning Science (Cont.)					
Develop multimedia presentations of group and individual research projects and investigations appropriate for a variety of audiences and forums		I	C		
Produce interesting and scientifically correct stories and present them using various modes of expression		I			
Reflect on the ideas and content found in their own journal records	R	R			
Examine ambiguous results and formulate explanations	I	R	C		
Recognize and synthesize the contributions to scientific thought of individuals from many cultures	I				
Construct models and simulations of the component structures and functions of living and non-living entities	R	R	R		
Recognize and choose members of research teams based upon the merit of their ideas and skills	R	R	R		
Construct a portfolio of products, documentation, and self-evaluations of his/her own abilities, skills, and experiences	I	R	C		
Synthesize scientific information from a variety of sources	R	C	R		
Evaluate and prioritize scientific issues based upon risk-benefit analyses	I	R	R		
Refining scientific skills from a variety of experiences	R	R	R		

Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	10	12	AD	LL	WS
Subunit: Applications for Science Learning					
Answer student-determined questions by designing databases and drawing inferences from the analyses of the information in these databases	I	R	C		
Make personal behavior decisions by interpreting information that has a scientific basis	I	R	C		
Propose courses of action that will validate and demonstrate personal understandings of scientific principles	R	C	R		
Guide other learners in their understanding of the interactions of technologies and society at various periods in time	I	R	C		
Promote and carry out practices that contribute to a sustainable environment	R	R	R		
Study and propose improvements in public services and systems in their community	I				
Choose consumer materials utilizing personal and environmental risk and benefit information	I	C	R		
Make inferences and draw conclusions using databases, spreadsheets, and other technologies	I	R	C		
Do simple trouble-shooting on common electrical and mechanical systems, identifying and eliminating possible causes of malfunctions		I	C		
Construct devices that perform simple, repetitive actions		I	C		

Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	10	12	AD	LL	WS
Subunit: Applications for Science Learning (Cont.)					
Investigate the functionality of various geometric shapes in the natural world and the designed world (e.g., translations from spherical to plan representations cause distortions, triangular shapes contribute to rigidity and stability in structures, round shapes minimize boundary for a given capacity)	I	C	R		
Make decisions regarding personal and public health	R	R	R		
Evaluate the social and ecological risks and benefits resulting from the use of various consumer products	I	R	C		
Analyze the contributions of advances in technology through history to his/her everyday life	R	R	C		
Identify and reduce risks and threats to a sustainable environment	I	R	C		
Extend the limits of human capabilities using technological enhancements	C	R	R		
Use and recognize various propaganda techniques	R	R	R		
Solve unique problems using the results of systematic analyses	R	C	R		
Choose everyday consumer products that utilize recent innovative and pass appropriate performance criteria	R	C			
Refine personal career interests through investigations of the diversity of manufacturing, research, service, and invention processes	R	R	C		
Predict and investigate the working of toys and tools while controlling and manipulating variables (e.g., friction, gravity, forces)	R	C	R		

Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	10	12	AD	LL	WS
Subunit: Applications for Science Learning (Cont.)					
Write, follow, modify, and extend instructions (e.g., equations, algorithms, formulas, flow diagrams, illustrations)	R	C	R		
Create products, make inferences, and draw conclusions using databases, spreadsheets, and other technologies	I	R	C		
Predict various scenarios and propose solutions to community issues using scientific information (e.g., actuarial tables, census data, topographic maps, incidence data, climatic data)	R	C	R		
Use scientific evidence to consider options and formulate positions about the health and safety of others and him/herself	I	C	R		
Search for, use, create, and store objects and information using various strategies and methods of organization and access	I	R	C		
Research and write environmental impact statements of his/her own design		I	R		
Compare school-based science perspectives with those gained through cutting-edge technological applications	I	R	R		
Design management plans for natural and human-altered environments (e.g., woodlots, patios, lots, lawns, farmlands, forests)	I	R	C		
Refine personal career interests	R	R	C		
Promote public awareness of the interaction of technology with social issues	I	R	R		

Unit: Communications Literacy (Ohio's Language Arts Model 9-12) *** = Industry identified these to be taught using applied methods** **Note: The remaining competencies are to be taught using regular or applied methods**	**10**	**12**	**AD**	**LL**	**WS**
Subunit: Applications for Science Learning (Cont.)					
Advocate and propose courses of action for local and global scientific issues using global networks	R	C	R		
Use appropriate technologies to prepare and present the findings of investigations incorporating tables, graphs, diagrams, and text	I	C	R		
Make informed consumer choices by evaluating and prioritizing information, evidence, and strategies	I	C			
Develop an informed point-of-view that allows for validation or refutation of the scientific statements and claims of advocated before pursuing courses of action (e.g., contributing support, signing petitions, casting votes)	I	R	R		
Differentiate between observations and inferences in the exploration of evidence related to personal, scientific, and community issues	I	C	R		
Develop and write environmental impact and safety and hygiene management plans		I	R		
Use technology to collect, analyze, and communicate information (e.g., electronic networks, desktop publishing, remote sensing, graphing calculators, satellite telemetry, and others	I	C	R		
Design, construct, and market inventions	I	R	C		

Unit: **Technology Literacy** *** = Industry identified these to be taught using applied methods**	10	12	AD	LL	WS
Demonstrate a systems view of technology based on the interdependence of social, political, economic, and ecological systems	I	R	R	✓	✓
Assess the career, family, and personal development implications of technological change	I	R	R	✓	✓
Demonstrate continuous learning via technology	I	R	R	✓	✓
Demonstrate global appreciation for technology's potential effects on cultures, geographic areas, and the environment	I	R	R	✓	✓
Apply historical perspective on technology to the development and use of new technologies	I	R	R	✓	✓
Apply diverse technologies to store, access, process, create, and communicate information needed to solve problems	I	R	R	✓	✓
Apply legal principles and ethical conduct to the use of technology	I	R	R	✓	✓
Demonstrate competency in mathematics, science, social sciences, communication, and computer skills through the analysis, design, and evaluation of technological systems	I	R	R	✓	✓
Analyze the potential of alternative technological systems to solve problems and/or to extend human capabilities	I	R	R	✓	✓
Use a variety of tools, materials, and equipment in solving problems and extending human capabilities	I	R	R	✓	✓
Assess risks and benefits of technological developments from an ecological, economic, social, and political perspective	I	R	R	✓	✓
Value human diversity as part of a team in suggesting, designing, and testing solutions to technological problems	I	R	R	✓	✓

Unit: Computer Literacy	**10**	**12**	**AD**	**LL**	**WS**
Competency: Describe personal computer operations	I	C			
Competency Builders:					
Explain how data is stored in main computer memory	I	C			
Explain how computer system executes program instruction	I	C			
Explain computer storage capacity	I	C			
Explain how data is represented	I	C			
Describe data storage techniques	I	C			
Identify types of memory	I	C			
Competency: Explain information processing cycle	I	R	C		
Competency Builders:					
Define operating systems (e.g., DOS, OS/2, UNIX)		I	C		
Describe difference between data files and program files	I	C			
Explain PC layout	I	C			
Competency: Describe interface devices and software techniques	I	R	C		
Competency Builders:					
Identify elements of user interface	I	C			
Identify hardware components and their advantages and disadvantages	I	C			
Competency: Operate computer hardware	I	R	C		
Competency Builders:					
Practice proper media handling techniques	I	C			
Identify hardware and its use	I	C			
Use hardware (e.g., mouse, diskettes, drive, modems, touch screen, printers, digitizers, scanners)	I	R	C		
Keyboard efficiently	I	C			
Demonstrate basic care of hardware	I	C			

Unit: Computer Literacy (Cont.)	10	12	AD	LL	WS
Competency: Use software	I	R	C	✓	✓
Competency Builders:					
Define software types and functions	I	R	C		
Describe basic disk operations and care	I	C			
Perform functions necessary to operate software	I	C			
List advantages and disadvantages of integrated and dedicated software	I	C			
Demonstrate basic proficiency in spreadsheet use		I	C		
Demonstrate basic proficiency in word processing	I	C			
Demonstrate basic proficiency in database use		I	C		
Demonstrate system commands	I	R	C		
Demonstrate proficiency in network use		I	C		
Competency: Demonstrate proficiency in computer programming fundamentals	▨	I	R	▨	▨
Competency Builders:					
Practice proper media handling techniques	I	C			
Operate system software	I	R	C		
Operate diagnostic software		I	C		
Construct flow charts		I	C		
Analyze flow charts		I	C		
Describe computer languages and their uses			R		
Write a simple computer program which requires operator input, performs analysis, and produces output			R		

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Unit: Technical Recording and Reporting	10	12	AD	LL	WS
Competency: Demonstrate proficiency in technical recording	I	R	C	✓	✓
Competency Builders:					
Interpret specifications or drawings	I	R	C	✓	✓
Observe process	I	R	C	✓	✓
Ask questions	I	R	C	✓	✓
Record process (e.g., flowchart, step-by-step)	I	R	C	✓	✓
Identify parameters	I	R	C	✓	✓
Record data	I	R	C	✓	✓
Maintain test logs	I	R	C	✓	✓
Compile cumulative reference notebook/record	I	R	C	✓	✓
Measure appropriate parameters	I	R	C	✓	✓
Draft preventive maintenance and calibration procedures	I	R	C	✓	✓
Competency: Demonstrate proficiency in technical reporting	I	R	C	✓	✓
Competency Builders:	I	R	C	✓	✓
Use data books and cross reference/technical manuals	I	R	C	✓	✓
Identify type of report needed	I	R	C	✓	✓
Compile relevant data	I	R	C	✓	✓
Design charts and graphs	I	R	C	✓	✓
Analyze data	I	R	C	✓	✓
Draw conclusions	I	R	C	✓	✓
Outline reports	I	R	C	✓	✓
Write reports	I	R	C	✓	✓
Present reports	I	R	C	✓	✓
Compose technical memoranda	I	R	C	✓	✓
Use effective layout and design			C		

Unit: Teamwork	10	12	AD	LL	WS
Competency: Demonstrate knowledge of teamwork	I	R	C		✓
Competency Builders:					
Define employee empowerment		I	C		
Differentiate work groups and teams		I	C		
Identify conditions essential to teamwork	I	R	C		
Explain influence of company culture on teamwork		I	C		
Identify appropriate situations for using teams	I	R	C		
Define team structures (e.g., cross functional, quality improvement, task force, quality circles)		I	C		
Identify team building concepts		I	C		
Describe characteristics and dynamics of teams		I	C		
Identify characteristics of effective team leaders and members	I	R	C		
Identify responsibilities of a valuable team member	I	R	C		
Identify methods of involving each member of a team	I	R	C	✓	
Explain how individuals from various backgrounds contribute to work-related situations (e.g., technical training, cultural heritage)	I	R	C	✓	
Explain the purpose of facilitators	I	R	C		
Define consensus	I	R	C		
Competency: Demonstrate teamwork	I	R	C	▨	▨
Competency Builders:					
Identify (mission) purpose of team and intended goal (include time frames)	I	R	C		
Structure team around purpose		I	C		
Define responsibility of team members	I	R	C		

Unit: Teamwork (Cont.)	10	12	AD	LL	WS
Competency: Demonstrate teamwork (Cont.)	I	R	C		
Contribute to efficiency and success of team	I	R	C	✓	
Work toward individual and team milestones		I	C	✓	
Analyze results of team project	I	R	C	✓	
Facilitate a team meeting		I	C	✓	
Assist team member(s) with problem	I	R	C	✓	
Monitor time frame	I	R	C	✓	
Competency: Use teamwork to solve problems	I	R	R		✓
Competency Builders:					
Identify appropriate situations for using teams	I	R	C		
Use problem-solving process in a team setting	I	R	R	✓	
Identify quality management processes/techniques		I	R		
Identify quality assurance processes/techniques		I	R		
Prepare presentation	I	R	R	✓	
Competency: Conduct meetings	I	R	R	✓	
Competency Builders:					
Plan agenda	I	R	R	✓	
Schedule meeting and location	I	R	R	✓	
Invite appropriate personnel	I	R	R	✓	
Solicit outside speakers as needed	I	R	R	✓	
Assign someone to take minutes	I	R	R	✓	
Make introductions	I	R	R	✓	
Invite questions and comments and group participation	I	R	R	✓	
Focus on agenda items	I	R	R	✓	
Assign appropriate action, time frame and accountability to tasks	I	R	R	✓	
Monitor time	I	R	R	✓	
Close meeting on time	I	R	R	✓	
Publish minutes in timely manner	I	R	R	✓	

Unit: Employability Skills	10	12	AD	LL	WS
Competency: Develop a career plan	I	R	C	✓	
Competency Builders:					
Identify current interests and aptitudes	I	R	C	✓	
Identify common barriers to employment		I	C		
Describe strategies to overcome employment barriers	I	R	C		
Locate resources for finding employment		I	C	✓	
Research job trends	I	R	C	✓	
Identify career options	I	R	C	✓	
Identify advantages and disadvantages of career options	I	R	C	✓	
Identify job requirements	I	R	C	✓	
Investigate education/training opportunities	I	R	C	✓	
Competency: Prepare for employment	I	R	C	✓	
Competency Builders:					
Identify traditional and non-traditional employment sources	I	R	C	✓	
Identify present and future employment opportunities	I	R	C	✓	
Research job opportunities including non-traditional careers	I	R	C	✓	
Compare salary ranges and benefit packages	I	R	C	✓	
Compile occupational profile	I	R	C	✓	
Identify rights and responsibilities of equal employment opportunity laws		I	C	✓	
Design resume and cover letter	I	R	C	✓	
Target resume		I	C	✓	
Secure references	I	R	C	✓	
Investigate generic and specific employment tests (e.g., civil service exam, drug screening)		I	C	✓	
Use follow-up techniques to enhance employment potential		I	C	✓	

Unit: Employability Skills (Cont.)	10	12	AD	LL	WS
Competency: Prepare for Employment (Cont.)	I	R	C	✓	
Demonstrate legible written communication skills using correct grammar, spelling, punctuation, and concise wording	I	R	C	✓	
Describe methods for handling illegal questions on job application forms and during interviews		I	C	✓	
Write letter of application		I	C	✓	
Investigate prospective employer		I	C	✓	
Explain critical importance of personal appearance, hygiene, and demeanor	I	R	C	✓	
Interpret job description	I	R	C	✓	
Demonstrate appropriate interview question and answer techniques	I	R	C	✓	
Demonstrate methods of handling difficult interview questions	I	R	C	✓	
Evaluate job offers		I	C	✓	
Write letter of acceptance		I	C	✓	
Write letter of declination		I	C	✓	
Competency: Evaluate positive self-esteem	I	R	C	✓	
Competency Builders:					
Identify factors that affect self-esteem	I	R	C	✓	
Compare effects of low self-esteem and high self-esteem	I	R	C	✓	
Identify strategies to promote positive self-esteem	I	R	C	✓	
Competency: Prepare personal budget	I	R	C	✓	
Competency Builders:					
Describe need for personal management records	I	R	C	✓	
Balance checkbook	I	R	C	✓	
Identify tax obligations	I	R	C	✓	
Analyze how credit affects financial security	I	R	C	✓	

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Unit: Employability Skills (Cont.)	**10**	**12**	**AD**	**LL**	**WS**
Competency: Prepare personal budget (Cont.)					
Compare types and methods of investments		I	C	✓	
Compare types and methods of borrowing		I	C	✓	
Compare types and methods of insurance	I	R	C	✓	
Compare types of retirement options/plans		I	C	✓	
Identify discriminatory vs. non-discriminatory expenditures	I	R	C	✓	
Competency: Demonstrate job retention skills	I	R	C		
Competency Builders:					
Identify employer expectations regarding job performance, work habits, attitudes, personal appearance, and hygiene	I	R	C	✓	
Exhibit appropriate work habits and attitude	I	R	C	✓	
Demonstrate ability to set priorities	I	R	C	✓	
Identify behaviors to establish successful working relationships	I	R	C	✓	
Identify alternatives for dealing with harassments, bias, and discrimination based on race, color, national origin, sex, religion, handicap, or age		I	C	✓	
Identify opportunities for advancement		I	C	✓	
List reasons for termination		I	C	✓	
List consequences of being absent frequently from job	I	R	C	✓	
List consequences of frequently arriving late for work	I	R	C	✓	
Demonstrate interpersonal relations skills	I	R	C	✓	
Demonstrate negotiation skills		I	C	✓	
Demonstrate teamwork	I	R	C	✓	
Follow chain-of-command	I	R	C	✓	

Unit: Employability Skills (Cont.)	10	12	AD	LL	WS
Competency: Demonstrate knowledge of work ethic	I	R	C		
Competency Builders:					
Define work ethic	I	R	C	✓	
Identify factors that influence work ethic	I	R	C	✓	
Differentiate between law and ethics		I	C	✓	
Describe how personal values are reflected in work ethic	I	R	C	✓	
Describe how interactions in the workplace affect personal work ethic		I	C	✓	
Describe how life changes affect personal work ethic	I	R	C	✓	
Competency: Exhibit characteristics that reflect appropriate work ethic	I	R	C	✓	
Competency Builders:					
Use time-management techniques	I	R	C	✓	
Avoid personal activity during work hours	I	R	C		
Attend work as scheduled	I	R	C		
Adhere to company and/or governmental policies, procedures, rules, and regulations	I	R	C		
Exercise confidentiality	I	R	C		
Demonstrate appropriate human relations skills	I	R	C		
Adhere to rules of conduct	I	R	C		
Accept constructive criticism	I	R	C		
Offer constructive criticism	I	R	C		
Take pride in work	I	R	C		
Resolve conflict	I	R	C	✓	
Manage stress	I	R	C		
Avoid sexual connotations and harassment	I	R	C		
Adjust to changes in the workplace	I	R	C		
Demonstrate punctuality	I	R	C		
Assume responsibility for personal decisions and actions	I	R	C	✓	
Take responsibility for assignments	I	R	C	✓	

Unit: Employability Skills (Cont.)	10	12	AD	LL	WS
Competency: Apply decision-making techniques in the workplace	I	R	C	✓	
Competency Builders:					
Identify decisions to be made	I	R	C	✓	
Identify ownership of decision to be made	I	R	C	✓	
Identify possible alternatives and their consequences	I	R	C	✓	
Make decisions based on facts, legality, ethics, goals, and/or corporate cultures	I	R	C	✓	
Apply time factor(s)	I	R	C	✓	
Present decision to be implemented	I	R	C	✓	
Evaluate decision made	I	R	C	✓	
Take responsibility for decision	I	R	C	✓	
Competency: Apply problem-solving techniques in the workplace	I	R	C	✓	
Competency Builders:					
Identify problems	I	R	C		
Select appropriate problem-solving tool/techniques	I	R	C		
Identify problem causes	I	R	C		
Identify possible solutions and their consequences	I	R	C		
Utilize resources to explore possible solutions to problem	I	R	C		
Contrast advantages and disadvantages of each solution	I	R	C		
Identify appropriate action	I	R	C		
Evaluate results	I	R	C		
Competency: Exhibit characteristics for job advancements	I	R	C		
Competency Builders:					
Display positive attitude	I	R	C	✓	
Demonstrate knowledge of position	I	R	C	✓	
Perform quality work	I	R	C	✓	
Adapt to changing situations and technology		I	C	✓	

Unit: Employability Skills (Cont.)	10	12	AD	LL	WS
Competency: Exhibit characteristics for job advancements (Cont.)	I	R	C		
Demonstrate capability for different positions		I	C	✓	
Identify characteristics of effective leaders	I	R	C	✓	
Identify opportunities for leadership in work place/community	I	R	C	✓	
Display creative abilities and initiative to affect change in workplace		I	C	✓	
Participate in continuing education/training program			C	✓	
Explain purpose of supervision, self-discipline and performance evaluation	I	R	C	✓	
Identify appropriate response(s) to criticism from employer, supervisor, or other employees			C	✓	
Display awareness of corporate culture			C	✓	
Prepare for job setbacks			C	✓	

Unit: Professionalism	10	12	AD	LL	WS
Competency: Project professional image		I	C	✓	
Competency Builders:					
Define professionalism		I	C	✓	
Exhibit professional appearance		I	C	✓	
Exhibit professional manners		I	C	✓	
Project professional attitude		I	C	✓	
Identify individual's vital role in organization		I	C	✓	
Exhibit proper etiquette in professionally-related situations		I	C	✓	
Competency: Achieve individual and professional goals	I	R	C	✓	
Competency Builders:					
Set flexible, realistic, and measurable goals	I	R	C	✓	
Identify potential barriers to achieving goals	I	R	C	✓	
Identify strategies for addressing barriers to goal achievement	I	R	C	✓	
Breakdown long-term goals into short-term goals	I	R	C	✓	
Prioritize goals	I	R	C	✓	
Make commitment to goals	I	R	C	✓	
Adjust goals	I	R	C	✓	
Obtain support of goals	I	R	C	✓	
Reward goal achievement	I	R	C	✓	
Competency: Support community well-being	I	R	C	✓	
Competency Builders:					
Identify environmental, educational, and social issues	I	R	C	✓	
Participate in social and/or community activities	I	R	C	✓	

Unit: Professionalism (Cont.)	10	12	AD	LL	WS
Competency: Achieve organizational goals	I	R		✓	
Competency Builders:					
Evaluate personal goals in relation to organizational goals	I	R			
Monitor progress by evaluating feedback	I	R			
List responsibilities in relation to organization goals	I	R			
Accomplish assigned tasks	I	R			
Exercise responsibility in relation to organizational goals	I	R			
Set appropriate personal performance standards	I	R			
Communicate goals with supervisor and peers	I	R			
Demonstrate knowledge of products and services			C	✓	
Promote organizational image and mission			C	✓	
Competency: Demonstrate positive relations with employers		I	C		
Competency Builders:					
Identify personality types of self and others		I			
Identify various management styles		I	C	✓	
Support employer expectations		I	C	✓	
Support employer decisions		I	C	✓	
Accept constructive criticism		I	C	✓	
Give constructive feedback		I	C	✓	
Adapt to changes in work place		I	C	✓	
List factors to consider before resigning		I	C	✓	
Write letter of resignation		I	C	✓	

Unit: Professionalism (Cont.)	10	12	AD	LL	WS
Competency: Manage stressful situations	I	R	R	✓	✓
Competency Builders:					
Accept stress as part of daily life	I	R	R	✓	✓
Identify personal and professional factors contributing to stress	I	R	R	✓	✓
Describe physical and emotional responses to stress	I	R	R	✓	✓
Evaluate positive and negative effects of stress on productivity	I	R	R	✓	✓
Identify strategies for reducing stress	I	R	R	✓	✓
Implement strategies to manage stress	I	R	R	✓	✓
Create strategies for developing and maintaining support systems	I	R	R	✓	✓
Competency: Analyze effects of family on work and work on family	I	R	C	✓	
Competency Builders:					
Identify how family values, goals, and priorities are reflected in work place	I	R	R	✓	
Identify responsibilities and rewards associated with paid and non-paid work	I	R	R	✓	
Identify responsibilities and rewards associated with families	I	R	R	✓	
Explain how family responsibilities can conflict with work	I	R	R	✓	
Explain how work can conflict with family responsibilities	I	R	R	✓	
Explain how work-related stress can affect families	I	R	R	✓	
Explain how family-related stress can affect work	I	R	R	✓	
Identify family support systems and resources	I	R	R	✓	
Identify work-related support systems and resources	I	R	R	✓	
Communicate with family regarding work	I	R	R	✓	

Unit: Professionalism (Cont.)	10	12	AD	LL	WS
Competency: Apply lifelong learning skills	I	R	R	✓	
Competency Builders:					
Define lifelong learning	I	R	C	✓	
Identify factors that cause need for lifelong learning	I	R	C	✓	
Analyze effects of change	I	R	R	✓	
Identify reasons why goals change	I	R	C	✓	
Describe importance of flexibility and adaptability		I	R	✓	
Evaluate need for continuing education/training		I	R	✓	
Competency: Manage professional development	I	R	R		
Competency Builders:					
Identify career opportunities	I	R	R	✓	
Modify career plan	I	R	R	✓	
Participate in continuing education/training opportunities			R	✓	
Document continuing education/training			R	✓	
Read profession-related manuals, technical journals, and periodicals			R	✓	
Attend meetings, workshops, seminars, conferences, and demonstrations			R	✓	
Participate in professional organizations			R	✓	
Build personal/professional mentor relationship			R	✓	
Build professional network			R	✓	
Strengthen communication skills	I	R	R	✓	
Strengthen leadership skills	I	R	R	✓	
Strengthen management skills	I	R	R	✓	

Computer Aided Drafting and Design, Industrial Manufacturing Technician, and Mechanical Engineering Technician

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Unit: Workplace Safety	10	12	AD	LL	WS
Competency: Apply general safety precautions	I	R	R		✓
Competency Builders:					
Follow local, state, and federal rules and regulations	I	R	R		
Identify personal protective wear and equipment	I	R	R		
Use personal protective wear and equipment	I	R	R		
Apply workplace safety rules and procedures	I	R	R		✓
Apply personal safety rules and procedures	I	R	R		
Apply workplace organization (e.g., housekeeping)	I	R	R		
Apply electrical, mechanical, stearin, hydraulic and pneumatic	I	R	R		
Apply fire safety rules and procedures	I	R	R		
Apply hazardous substances rules and procedures	I	R	R		✓
Apply first aid and CPR procedures	I	R	R		
Describe corrective procedures for unsafe conditions	I	R	R		
Identify visual controls (e.g., monitors, read outs)	I	R	R		
Identify auditory controls	I	R	R		
Perform lockout and tagout	I	R	R		✓
Explain purpose of American Disability Act	I	R	R		
Competency: Demonstrate knowledge of workplace hazards	I	R	R		✓
Competency Builders:	I	R	R		
Identify types of workplace hazards (e.g., physical hazards, fire, chemicals, noise, ionizing radiation, ultraviolet, temperature extremes, ergonomics, biological hazards)	I	R	R		
Interpret hazardous materials notices on containers	I	R	R		
Locate MSDS	I	R	R		

Unit: Workplace Safety (Cont.)	10	12	AD	LL	WS
Competency: Demonstrate knowledge of workplace hazards (Cont.)	I	R	R		✓
Read Material Safety Data Sheets (MSDS)	I	R	R		
Explain purpose(s) of OSHA and NIOSH	I	R	R		
Explain purpose(s) of NEC and NFPA	I	R	R		
Identify purpose of emergency evacuation routes, master switch and lockout locations, and safety color coding systems	I	R	R		
Identify roles of industrial hygienists, safety professionals, occupational physicians, and occupational nurses	I	R	R		
Describe methods of evaluating potential hazards (e.g., visual analysis)	I	R	R		
Describe methods of correcting potential hazards	I	R	R		
Describe various types of toxicity (e.g., chronic, immediate)	I	R	R		
Identify need for reporting accidents	I	R	R		
Explain precautions required when using toxic or flammable materials	I	R	R		
Define confined space and related requirements	I	R	R		
Competency: Explain purpose of industrial pollution control systems	I	R	R		✓
Competency Builders:					
Describe types of air, water, solid waste, and noise pollution	I	R	R		✓
Explain purpose of air pollution control systems	I	R	R		✓
Explain purpose of water pollution control systems	I	R	R		✓
Explain purpose of solid waste pollution control systems	I	R	R		✓
Explain basic philosophy of "right to know" legislation	I	R	R		✓
Explain purpose(s) of EPA	I	R	R		✓
Recycle scrap metal, chips, shavings, coolants, solvents, trash, and waste materials	I	R	R		✓

Unit: Quality Assurance	10	12	AD	LL	WS
Competency: Demonstrate knowledge of quality assurance		I	R		✓
Competency Builders:					
Explain the historical evolution of quality assurance (e.g., Demming, ISO 9000)		I	R		
Define quality terms		I	R		
Define quality functions		I	R		
Identify features of quality planning		I	R		
Describe control devices used in funcitonal areas (e.g., SPC, equipment)		I	R		
Explain the relationship among organizational structures, policies, procedures, and quality assurance		I	R		
Explain importance of interanal and external customers		I	R		
Identify internal and external customers		I	R		
Explain importance of interdepartmental relationships		I	R		
Describe successful efforts by industry to improve quality and/or reduce costs		I	R		
Differentiate prevention and detection		I	R		
Differentiate variable and attribute data		I	R		
Identify types of charts		I	R		
Explain how statistical techniques are tools used to control quality		I	R		
Competency: Demonstrate knowledge of quality costs and implications			I		
Competency Builders:					
Identify cost/quality objectives			I		
Differentiate convergent and divergent thinking			I		
Classify costs (i.e., direct and indirect, fixed and variable, methods and standards)			I		
Classify quality costs (i.e., prevention, evaluation, pre-delivery failure, post-delivery failure)			I		

Unit: Quality Assurance (Cont.)	10	12	AD	LL	WS
Competency: Demonstrate knowledge of quality costs and implications (Cont.)			I		
Define product liability		I	R		
Explain consumerism and liability prevention		I	R		
Define safety terms of product		I	R		
Identify safety responsibility within organization		I	R		
Differentiate contracts and torts		I	R		
Differentiate express and implied warranty		I	R		
Explain how warranties are part of contract law		I	R		
List questions that would need answering in a liability claim		I	R		
Competency: Explain importance of interdepartmental relationships to quality assurance			I		✓
Competency Builders:					
Explain how quality assurance philosophy has changed in recent years			I		
Explain need for everyone's commitment in assuring quality			I		
Explain phrase "Everyone is a customer/supplier"			I		
Define quality improvement team models			I		
Explain project selection			I		
Explain project implementation			I		
Explain project evaluation			I		
Explain continuing improvement			I		
Describe future trend of experiment design			I		
Describe future trend of predictive maintenance			I		

Unit: Quality Assurance (Cont.)	10	12	AD	LL	WS
Competency: Demonstrate knowledge of basic statistics		I	C		
Competency Builders:					
Select data collection methods		I	C		
Collect data		I	C		
Organize data by flow chart		I	C		
Organize data by cause and effect diagrams		I	C		
Define nominal, ordinal, interval, and ratio data		I	C		
Explain differences of random sampling methods		I	C		
Develop parieto chart		I	C		
Define mean, median, and mode		I	C		
Construct histogram		I	C		
Interpret histogram		I	C		
Compute standard deviation		I	C		
Explain significance of standard deviation		I	C		
Develop run chart		I	C		
Explain normal distribution		I	C		
Define "in-control process"		I	C		
Competency: Demonstrate knowledge of scattergrams			C		
Competency Builders:					
Construct scattergram			C		
Interpret for positive, negative, or no correlation between X and Y variables			C		
Test for significance between one and five percent			C		
Competency: Demonstrate knowledge of probability theory		I	C		✓
Competency Builders:					
Define classical probability		I	C		
Define empirical probability		I	C		
Calculate probability for outcomes		I	C		

Unit: Quality Assurance (Cont.)	10	12	AD	LL	WS
Competency: Demonstrate knowledge of precontrol		I	C		✓
Competency Builders:		I	C		
Explain uses of precontrol		I	C		
Calculate precontrol limits		I	C		
Explain significance of the limits		I	C		
Plot values on a precontrol chart		I	C		
Explain "out-of-control" situation		I	C		
Make decisions on green, yellow, and red conditions		I	C		
Competency: Demonstrate knowledge of process capability		I	C		
Competency Builders:					
Use X, R, USL, and LSL to determine process capability (upper and lower specification limits)		I	C		
Calculate estimated process standard deviation		I	C		
Plot right hand and left hand tail of process variation		I	C		
Compute Z value for percent of probable defect for process		I	C		
Calculate CPK values that describe process capability		I	C		
Describe skewed distributions		I	C		
List probable causes of skewed distribution		I	C		

Unit: Quality Assurance (Cont.)	10	12	AD	LL	WS
Competency: Use quality control charts		I	R		✓
Competency Builders:					
Identify operational definitions for attribute criteria		I	R		
Interpret X and R chart		I	R		
Interpret histogram		I	R		
Interpret scattergrams		I	R		
Interpret NP chart		I	R		
Interpret P chart		I	R		
Interpret flowchart		I	R		
Interpret cause-and-effect diagram		I	R		
Construct P (percentage defective) chart for attributes		I	R		
Plot control limits of P chart and data points		I	R		
Check chart for out-of-control conditions		I	R		
Construct NP (number defective) chart with control limits and data		I	R		
Construct C (count of defects) and U (number of defects per unit) charts		I	R		
Construct flowchart		I	R		
Construct cause-and-effect chart		I	R		
Competency: Interpret X and R charts		I	C		
Competency Builders:					
Plot percentages for normal distribution		I	C		
Test distribution for normality		I	C		
Explain difference between common cause and special cause		I	C		
Explain significance of an out-of-control point on X and R chart		I	C		
Identify patterns and trends on control chart		I	C		
Identify run up and run down		I	C		

Unit: Quality Assurance (Cont.)	10	12	AD	LL	WS
Competency: Interpret X and R charts (Cont.)		I	C		
Test for middle third on control chart		I	C		
Explain significance of middle third on control chart		I	C		
Explain Rule of Sevens		I	C		
Competency: Construct X and R charts		I	C		
Competency Builders:					
Arrange data into statistical subgroups		I	C		
Explain importance of random sampling		I	C		
Compute X (i.e., average of values) and R (i.e., range of values in subgroup) within sample		I	C		
Plot in X and R on chart		I	C		
Construct control chart with X (grand average) and R (average range) calculated		I	C		
Calculate upper and lower control limits for X-chart		I	C		
Calculate upper and lower control limits for R-chart		I	C		
Competency: Conduct process improvement studies		I	R		✓
Competency Builders:					
Analyze production methods and processes applying statistical process improvement techniques (e.g., SPC, C_pK)		I	R		
Identify appropriate statistical techniques for study (e.g., T-test, F-test, capability, DOEX)		I	R		
Identify major steps in conducting a study		I	R		
Define "report" for a study (e.g., goal, objective, study conduct, results, conclusions, discussions)		I	R		
Integrate results into the total system		I	R		

Unit: Quality Assurance (Cont.)	**10**	**12**	**AD**	**LL**	**WS**
Competency: Demonstrate knowledge of inspection		I	C		
Competency Builders:					
Explain the purpose of inspection	I	R	C		
Describe scope of inspection	I	R	C		
Explain purpose of incoming, ongoing, and final inspections	I	R	C		
Explain early detection inspection	I	R	C		
Explain how statistical process control (SPC) aids inspection	I	R	C		
Define types of nonconformance	I	R	C		
Define corrective action	I	R	C		
Describe when to 100% inspect	I	R	C		
Describe when to sample inspect	I	R	C		
Describe methods of testing for material properties (e.g., harness, strength, chemical makeup, flaws, errors in tooling or setup)	I	R	C		
Define rework, salvage, and scrap	I	R	C		
Describe ethical decisions an inspector may make		I	C		
Identify purposes of computer-automated inspection		I	C		
Explain advantages and disadvantages of automated inspection		I	C		
Competency: Inspect machinery, materials, and products		I	R		✓
Competency Builders:					
Identify critical material characteristics from specification(s) or drawing(s)		I	R		
Perform capability studies for machinery and materials acceptance		I	R		
Identify appropriate acceptance sampling plan		I	R		
Conduct incoming materials inspection using sampling plan criteria		I	R		
Identify critical in-process characteristics from specification(s) or drawing(s)		I	R		

Unit: Quality Assurance (Cont.)	10	12	AD	LL	WS
Competency: Inspect machinery, materials, and products (Cont.)		I	R		✓
Conduct in-process inspection		I	R		
Define appropriate inspection reports and follow-up		I	R		
Gauge R and R (reproducibility and repeatability)		I	R		
Use geometric tolerancing		I	R		
Competency: Demonstrate knowledge of nondestructive testing		I	R		
Competency Builders:					
Describe purpose of nondestructive testing		I	R		
Identify anomalies		I	R		
Define defects and discontinuities		I	R		
Identify factors contributing to defects and discontinuities		I	R		
Describe ultrasonic testing		I	R		
Describe advantages and limitations of ultrasonic testing		I	R		
Describe industrial radiography		I	R		
Compare use of wet and dry particles in magnetic particle inspection		I	R		
Explain advantages and limitations of pentrant inspection		I	R		
Describe microwave testing		I	R		
Describe holographic inspection		I	R		
Explain choice of most suitable nondestructive test method		I	R		

Unit: Drafting Technology	10	12	AD	LL	WS
Competency: Apply basic drafting skills	I	C		✓	
Competency Builders:					
Use drafting equipment, measuring scales, drawing media, drafting instruments and consumable materials	I	C			
Identify line styles, weights (alphabet of lines)	I	C			
Select proper drawing scale	I	C			
Prepare title blocks and other drafting formats	I	C			
Apply various freehand and other lettering techniques	I	C			
Prepare multi-view drawings	I	C			
Prepare multi-view sketches	I	C			
Prepare orthographic views	I	C			
Prepare change control block/revision block	I	C			
Describe change control purpose and procedure	I	C			
Measure angles	I	C			
Draw horizontal, vertical, angular, parallel, and perpendicular lines	I	C			
Transfer an angle	I	C			
Construct tangent lines (to arcs) and tangent arcs (to arcs)	I	C			
Bisect angles and arcs	I	C			
Bisect lines	I	C			
Divide lines	I	C			
Construct three-point circle	I	C			
Construct regular hexagon, pentagon, and octagon	I	C			
Reproduce a drawing	I	C			
Prepare single-view drawings	I	C			
Prepare dimension drawings	I	C			
Interpret notes and dimensions to determine parts	I	C			
Draw arcs and circles	I	C			
Transfer measurements	I	C			

Unit: Drafting Technology (Cont.)	10	12	AD	LL	WS
Competency: Apply intermediate drafting skills	I	R	C		
Competency Builders:					
Describe types of blueprints and their applications	I	R	C		
Apply isometric, oblique and perspective sketching techniques	I	R	C		
Prepare isometric, oblique and perspective sketches	I	R	C		
Prepare sectional views	I	R	C		
Prepare auxiliary views	I	R	C		
Identify ANSI symbols	I	R	C		
Prepare views of drilled and tapped holes, counterbores, countersinks	I	R	C		
Apply systems drafting techniques	I	R	C		
Identify a bill of materials	I	R	C		
Dimension drawings using ANSI$_{y}$14.5 standard	I	R	C		
Describe purpose of auxiliary and sectional views	I	R	C		
Competency: Apply advanced drafting skills		I			✓
Competency Builders:					
Interpret reports and specifications		I	R		✓
Prepare pictorial drawings	I	R	C		
Prepare schematics	I	R	C		
Draw conics		I			✓
Interpret basic pneumatic/hydraulic standards and symbols		I			✓
Interpret various drawings (e.g., welding, casting, stamping, forging, civil, maps, pattern shops)	I	R	C		
Competency: Read basic blueprints	I	C		✓	
Competency Builders:					
Visualize objects from drawing	I	C			
Comprehend orthographic projections	I	C			
Comprehend sectional views	I	C			
Interpret dimensions	I	C			

Unit: Drafting Technology (Cont.)	10	12	AD	LL	WS
Competency: Read intermediate-level blueprints		I	C		
Competency Builders:					
Comprehend detail and assembly drawings	I	R	C		
Interpret tolerances	I	R	C		
Interpret screw thread specifications	I	R	C		
Identify structional steel shapes		I	C		
Competency: Read advanced-level blueprints		I	R		
Competency Builders:					
Interpret GD&T characteristics symbols		I	R		✓
Interpret GD&T supplementary symbols		I	R		✓
Interpret special symbols		I	R		✓
Competency: Demonstrate knowledge of basic tolerancing			C		✓
Competency Builders:					
Identify geometric characteristics and symbols (i.e., flatness, straightness, roundness, cylindricity, profile of line, profile of surface, perpendicularly, angularity, parallelism, circular, runout, total indicated runout, position, concentricity, and symmetry)		I	C		
Define maximum material condition		I	C		
Define least material condition		I	C		
Define regardless of feature size condition		I	C		
Describe feature control blocks			C		
Describe datum surfaces and targets			C		
Define flatness (pitch)			C		
Define straightness (yaw)			C		
Define roundness			C		
Define cylindrically			C		
Define profile of line			C		
Define profile of surface			C		

Unit: Drafting Technology (Cont.)	10	12	AD	LL	WS
Competency: Demonstrate knowledge of basic tolerancing (Cont.)			C		✓
Define perpendicularity			C		
Define angularity			C		
Define parallelism			C		
Define circular runout			C		
Define total runout			C		
Apply true position concept to determine tolerance for location of holes in mating parts			C		
Dimension fits, tolerances, and symbols			C		
Competency: Convert dimensions and tolerances	I	C		✓	
Competency Builders:					
Convert dimensions and tolerances from English units to metric units	I	C			
Convert dimensions and tolerances from metric units to English units	I	C			
Competency: Demonstrate basic dimensioning techniques	I	C		✓	
Competency Builders:					
Construct arrowheads	I	C			
Dimension arcs	I	C			
Dimension angles	I	C			
Dimension rounded-end shapes	I	C			
Dimension spherical objects	I	C			
Dimension cylindrical objects	I	C			
Add notes to drawing	I	C			
Competency: Demonstrate intermediate-level dimensioning techniques	I	R	C		
Competency Builders:					
Dimension cones, pyramids, and prisms	I	R	C		
Dimension features on circular center line	I	R	C		
Dimension object using rectangular coordinate system	I	R	C		

Unit: Drafting Technology (Cont.)	10	12	AD	LL	WS
Competency: Demonstrate advanced-level dimensioning techniques		I	R		✓
Competency Builders:					
Dimension complex curves		I	R		✓
Dimension theoretical point of intersection		I	R		✓
Dimension object using polar coordinate system		I	R		✓
Dimension object using tabular coordinate system		I	R		✓
Dimension object using ordinate dimensioning system		I	R		✓
Apply symbols for surface and texture control		I	R		✓
Interpret decimal tolerance dimensions		I	R		✓
Competency: Prepare charts and graphs	I	R	C		
Competency Builders:					
Prepare line, bar and pie charts	I	R	C		
Prepare flow charts	I	R	C		
Competency: Prepare advanced charts and graphs		I	R		✓
Competency Builders:					
Prepare surface charts		I	R		✓
Prepare polar, rectangular and semi-logarithmic graphs		I	R		✓
Competency: Prepare mechanical drawings			I		✓
Competency Builders:					
Interpret basic mechanical standards and symbols		I	R		✓
Prepare assembly drawings		I	R		✓
Prepare welding drawings		I	R		✓
Prepare bearing drawings			I		✓
Prepare casting drawings		I	R		✓
Prepare forging drawings			I		✓
Prepare tool drawings			I		✓
Prepare molding diagrams			I		✓

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Unit: Drafting Technology (Cont.)	**10**	**12**	**AD**	**LL**	**WS**
Competency: Prepare mechanical drawings (Cont.)			I		✓
Prepare drawings with special processed holes		I	R		✓
Prepare stamping drawings			I		✓
Prepare numerical control drawings			I		✓
Produce installation drawings			I		✓
Competency: Prepare advanced mechanical drawings			I		✓
Competency Builders:					
Resolve problems by descriptive geometry and revolutions			I		✓
Prepare advanced surface drawings			I		✓
Use precision dimensioning to include geometric characters			I		✓
Use precision measuring instruments (e.g., calipers)		I	R		✓
Make engineering changes on drawings		I	R		✓
Prepare fastener drawings		I	R		✓
Prepare cam drawings			I		✓
Prepare gear drawings			I		✓
Prepare spring drawings			I		✓
Prepare pulley and chain drive drawings			I		✓

Unit: Fundamental Computer-Aided Drafting (CAD) Applications	**10**	**12**	**AD**	**LL**	**WS**
Competency: Use CAD to prepare drawings	I	C		✓	
Competency Builders:					
Log in on PC or work station	I	C			
Load CAD software	I	C			
Load title block	I	C			
Load existing drawing	I	C			
Create features (e.g., lines, circles, ellipses, splines, text) using keyboard and/or mouse or digitizer	I	C			
Use CAD program functions (e.g., line parallel to offset, cross hatch, copy, move, rotate, cut, trim) to improve productivity	I	C			
Plot drawing	I	C			
Competency: Prepare basic computer-aided drawings	I	C		✓	
Competency Builders:					
Use a pointing device	I	C			
Edit drawings	I	C			
Competency: Operate CAD system	I	C		✓	
Competency Builders:					
Load CAD system	I	C			
Start CAD system	I	C			
Utilize keyboard input	I	C			
Utilize screen menus	I	C			
Utilize input devices	I	C			
Access on-line help for commands	I	C			
Utilize file management	I	C			
Utilize output devices	I	C			
Select entities for action	I	C			
Manipulate layers	I	C			
Draw utilizing absolute and relative cartesian and polar coordinates	I	C			
Draw using construction aides	I	C			

Unit: Fundamental Computer-Aided Drafting (CAD) Applications (Cont.)	10	12	AD	LL	WS
Competency: Operate CAD system (Cont.)	I	C		✓	
Edit entity properties	I	C			
Use multiple software applications	I	C			
Create dimensions	I	C			
Competency: Annotate orthographic drawings	I	C		✓	
Competency Builders:					
Select text styles	I	C			
Apply notes	I	C			
Competency: Control display		C		✓	
Competency Builders:					
Apply view control while drawing (e.g., zoom and pan)	I	C			
Control view resolution (e.g., viewer)		C			
Save views	I	C			
Display views	I	C			
Competency: Extract entity and drawing information	I	C		✓	
Competency Builders:					
Measure distances	I	C			
Measure areas	I	C			
Identify locations	I	C			
List entity characteristics (e.g., length, size, location, properties, etc.)	I	C			
Competency: Manage symbols and attributes		I	R	✓	
Competency Builders:					
Create blocks and W-blocks	I	C			
Create nested blocks		I	C		
Insert blocks and drawings	I	C			
Redefine blocks	I	C			
Edit blocks	I	C			

Unit: Fundamental Computer-Aided Drafting (CAD) Applications (Cont.)	10	12	AD	LL	WS
Competency: Manage symbols and attributes (Cont.)		I	R		✓
Competency Builders:					
Create or define attributes		I	R		✓
Insert attributes		I	R		✓
Edit attributes		I	R		✓

Unit: Intermediate CADD Technology	10	12	AD	LL	WS
Competency: Use CAD to prepare drawings	I	R	C		
Competency Builders:					
Merge drawing files	I	R	C		
Dimension drawing using ANSI$_{y}$14.5 geometric dimensioning and tolerancing	I	R	C		
Produce drawing including auxiliary and section views	I	R	C		
Competency: Prepare computer-aided drawings	I	R	C		
Competency Builders:					
Use a plotter	I	R	C		
Select the proper drawing scale	I	R	C		
Produce charts and graphs	I	R	C		
Produce multi-view drawing with dimensions	I	R	C		
Produce sectional view drawings with dimensions	I	R	C		
Produce auxiliary view drawings with dimensions	I	R	C		
Utilize system commands	I	R	C		
Competency: Demonstrate basic computer skills including proficiency with DOS	I	R	C		
Competency Builders:					
Create ASCII text files with a text editor	I	R	C		
Explain rules for naming files and directories	I	C			
Create directories	I	C			
Remove directories	I	C			
Change directories	I	C			
Copy files	I	C			
Rename files	I	C			
Erase files	I	C			
Format diskettes	I	C			

Unit: Intermediate CADD Technology (Cont.)	10	12	AD	LL	WS
Competency: Demonstrate basic computer skills including proficiency with DOS (Cont.)	I	R	C		
Label diskettes	I	C			
Explain the syntax of DOS commands	I	R	C		
Utilize wildcards in DOS commands	I	R	C		
Utilize communication tools (e.g., modem, cellular)	I	R	C		✓
Competency: Operate CAD system	I	R	C		
Competency Builders:					
Create scaled plots	I	R	C		
Operate plotter	I	R	C		
Set system variables	I	R	C		
Competency: Dimension orthographic drawings	I	R	C		
Competency Builders:					
Edit dimensions	I	R	C		
Control dimension variables	I	R	C		
Competency: Annotate orthographic drawings	I	R	C		
Competency Builders:					
Create text styles	I	R	C		
Edit text styles	I	R	C		
Competency: Use external routines	I	R	C		
Competency Builders:					
Load AutoLISP programs	I	R	C		
Execute AutoLISP programs	I	R	C		
Load ADS programs	I	R	C		
Execute ADS programs	I	R	C		

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Unit: Advanced CADD Technology	10	12	AD	LL	WS
Competency: Apply CAD drafting skills or drawing media			I		✓
Competency Builders:					
Create detail drawing(s) including basic machine elements (e.g., fasteners, gears, springs, bearings, holes, threads, welds)		I	R		
Differentiate between a drawing for machining and patterns			I		✓
Prepare assembly drawing including bill of materials		I	R		✓
Create a block library		I	R		✓
Perform fundamental customization			I		✓
Import external data (e.g., IGES, DXF)			I		✓
Competency: Use CAD to prepare drawings		I	R		✓
Competency Builders:					
Prepare symbol library (e.g., electrical/electronic, electrical/hydraulic, welding)		I	R		✓
Construct a solid model		I	C		
Prepare CAD drawing for use in CAM environment		I	R		✓
Competency: Prepare computer-aided drawings		I	R		✓
Competency Builders:					
Produce pictorial drawings		I	R		✓
Operate other peripheral equipment		I	R		✓
Prepare symbol library		I	R		✓
Produce drawing portfolio (e.g., presentation quality drawings, working drawings)		I	R		✓
Competency: Prepare specialized CAD drawings			I		✓
Competency Builders:					
Prepare electrical/electronic CAD drawings		I			✓
Prepare pneumatic/hydraulic CAD drawings			I		✓
Prepare structural CAD drawings		I			✓

Unit: Advanced CADD Technology (Cont.)	10	12	AD	LL	WS
Competency: Prepare specialized CAD drawings (Cont.)			I		✓
Prepare mechanical CAD drawings		I	R		✓
Prepare architectural CAD drawings		I	R		✓
Prepare civil CAD drawings			I		✓
Competency: Control display			I		✓
Competency Builders:			I		
Create slides			I		✓
Display slides			I		✓
Perform function analysis			I		✓
Competency: Manage symbols and attributes			I		✓
Competency Builders:					
Create custom hatch patterns			I		✓
Create custom linetypes			I		✓
Competency: Create 2-D isometric drawings		I	R		✓
Competency Builders:					
Manipulate snap and grid settings		I	R		✓
Toggle planes (e.g., left, right, top)		I	R		✓
Create text styles for each plane		I	R		✓
Create dimension styles		I	R		✓
Use dimension styles		I	R		✓
Create isometric ellipses		I	R		✓
Competency: Use external routines			I		✓
Competency Builders:					
Create script files			I		✓
Utilize interdisciplinary design software (e.g., mechanical, industrial, technical)			I		✓
Competency: Create custom menus			I		✓
Competency Builders:					
Demonstrate search routines when using a text editor			I		✓
Write screen menus and macros			I		✓

Unit: Advanced CADD Technology (Cont.)	10	12	AD	LL	WS
Competency: Create custom menus (Cont.)			I		✓
Write tablet menus and macros			I		
Write cascading pop-down menus and macros			I		✓
Write icon menus and macros			I		✓
Write button menus and macros			I		✓
Write other customizable CAD files (e.g., ACAD.PCP)			I		✓
Edit other customizable CAD files (e.g., ACAD.PCP)			I		✓
Competency: Create 3-D wireframe models			C		✓
Competency Builders:					
Explain the difference between extrusions, wireframes, surface models, and solid models			C		
Create user coordinate systems		I	C		
Manipulate user coordinate systems		I	C		
Utilize cylindrical coordinates			C		
Utilize spherical coordinates			C		
Utilize .XYZ filters		I	C		
Project geometry from one plane to another			C		
Competency: Create 3-D surface models			I		✓
Competency Builders:					
Define B-rep surfaces			I		✓
Explain the difference between B-rep surfaces and non-uniform rational B-splines (NURB'S)			I		✓
Create tabulated surfaces			I		✓
Create ruled surfaces			I		✓
Create revolved surfaces			I		✓
Create edge surfaces (coon's patch)			I		✓
Apply surface meshes to 3-D wireframes			I		✓
Modify visibility of the edges of faces			I		✓

Unit: Advanced CADD Technology (Cont.)	10	12	AD	LL	WS
Competency: Create 3-D surface models (Cont.)			I		✓
Dimension of a 3-D model for both isometric and orthographic drawings			I		✓
Control dimension scale with regard to plotting scales		I	R		✓
Project geometry onto 3-D surface			I		✓
Utilize paper space/model space		I	R		✓
Competency: Utilize advanced plotting techniques			I		✓
Competency Builders:					
Define viewpoints and angle of rotation			I		✓
Control display angle (e.g., dview, vpoint)			I		✓
Competency: Create 3-D solid models			C		✓
Competency Builders:					
Differentiate between B-rep solid modeling and Constructive Solid Geometry (CSG) modeling			C		
Create solid primitives			C		
Modify solid primitives			C		
Create swept solids			C		
Utilize Boolean operations to create complex solids (e.g., unions, subtractions, intersections, separations)			C		
Fillet solid models			C		
Chamfer solid models			C		
Extract mass properties from a solid model			C		
Create 2-D profiles and sections from a solid modeling			C		
Explain the limitations of solid modeling			C		

Unit: Advanced CADD Technology (Cont.)	10	12	AD	LL	WS
Competency: Apply advanced display control			I		✓
Competency Builders:					
Utilize clipping planes to section a model			I		✓
Apply perspective views			I		✓
Place camera and target points to locate views			I		✓
Place lights for rendering			I		✓
Control lights for rendering			I		✓
Create rendered images of surfaces and solid models			I		✓
Competency: Write programs using AutoLISP			I		✓
Competency Builders:					
Perform simple math functions			I		✓
Perform nested math functions			I		✓
Write routine which prompts for user input, performs calculations and creates or edits geometry			I		✓
Identify common error codes			I		✓
Format a program to display balanced parentheses and nesting of functions			I		✓
Write a program including and "if/then/else" statement			I		✓

Unit: Test and Measurement Equipment	10	12	AD	LL	WS
Competency: Demonstrate proficiency in use of test equipment			I	✓	✓
Competency Builders:					
Describe function and operation of hardness test equipment	I	R	C		
Describe function and operation of stress and strain equipment			I	✓	✓
Competency: Demonstrate proficiency in use of measurement equipment			I		✓
Competency Builders:					
Describe function and operation of air flow measurement devices			I	✓	✓
Describe function and operation of air quality measurement devices			I	✓	✓
Describe function and operation of light measurement devices			I	✓	✓
Describe function and operation of venier	I	C			
Describe function and operation of micrometers	I	C			
Describe function and operation of transit			I	✓	✓
Describe function and operation of comparaters			I	✓	✓
Describe function and operation of digital readout test equipment	I	R	C		
Competency: Apply quality control techniques			I	✓	✓
Competency Builders:					
Perform preventative maintenance		I	R	✓	✓
Perform predictive maintenance			I	✓	✓
Apply statistical process control (SPC)			I	✓	✓
Recalibrate equipment		I	R	✓	✓
Apply problem-solving tools and techniques	I	R	R	✓	✓

Unit: Equipment Installation	10	12	AD	LL	WS
Competency: Demonstrate knowledge of installation procedures			I		✓
Competency Builders:					
Explain location procedures for new equipment in an existing facility			I	✓	✓
Explain the use of anchors and isolators			I	✓	✓
Explain procedures for moving and installing new equipment			I	✓	✓
Explain leveling and aligning procedures			I	✓	✓
Explain test run guidelines			I	✓	✓
Explain safety precautions for equipment installation procedures		I	R	✓	✓
Explain installation of utilities (e.g., electricity, air, water, drains)			I	✓	✓
Competency: Prepare for equipment installation		I	R	✓	✓
Competency Builders:					
Identify equipment requirements (including safety)		I	R	✓	✓
Identify maintenance services		I	R	✓	✓
Identify method of moving equipment		I	R	✓	✓
Read drawings and schematics		I	R	✓	✓
Revise drawings		I	R	✓	✓
Interpret blueprints		I	R	✓	✓
Competency: Install equipment			I	✓	✓
Competency Builders:					
Prepare site			I	✓	✓
Use measuring devices	I	R	C	✓	✓
Calculate weight		I	R	✓	✓
Follow manufacturer's specifications		I	R	✓	✓
Apply electrical, mechanical, hydraulic, and/or pneumatic principles		I	R	✓	✓

Unit: Equipment Installation (Cont.)	10	12	AD	LL	WS
Competency: Perform rigging functions			I		✓
Competency Builders:					
Estimate the weight of a load		I	R	✓	✓
Find the center of gravity			I	✓	✓
Identify the rigging and slings used in maintenance work			I	✓	✓
Explain safety inspection procedures for rigging, ropes, and slings		I	R	✓	✓
Perform safety inspection procedures for rigging, ropes, and slings			I	✓	✓
Identify rope fiber types			I	✓	✓
Tie rigging knots, bends, and hitches	I	R	R	✓	✓
Identify types of wire rope			I	✓	✓
Cut wire rope			I	✓	✓
Seize wire rope			I	✓	✓
Install wire rope eyes, sockets, and hooks			I	✓	✓
Identify cranes and hoists			I	✓	✓
Splice wire rope			I	✓	✓
Erect a scaffold			I	✓	✓
Rig life belts and nets			I	✓	✓

Unit: Equipment Maintenance	10	12	AD	LL	WS
Competency: Perform housekeeping	I	C		✓	
Competency Builders:					
Dispose of scrap metal chips, shavings, trash and waste	I	C			
Clean work area	I	C			
Store hand tools, cutters, fixtures, jigs and attachments	I	C			
Store grinding wheels	I	C			
Follow tool crib procedures	I	C			
Report problems to supervisor	I	C			
Competency: Perform recordkeeping			I		✓
Competency Builders:					
Complete work order		C			
Complete internal requisition		I	C		
Complete external requisition		I	C		
Complete time cards		I	C		
Complete job status reports		I	R	✓	✓
Complete equipment failure reports		C			
Record preventative maintenance activities		I	C		
Record repair activities		C			
Read job orders and process sheets		C			
Locate tooling and set up information		I	C		
File reports	I	C			
Analyze systems failure			I	✓	✓
Make minor adjustments/repairs	I	R	C		
Coordinate maintenance services			I	✓	✓
Prepare new/replacement equipment recommendations			I	✓	✓
Competency: Inspect machine systems			I		✓
Competency Builders:					
Explain planned maintenance		I	R	✓	✓
Explain predictive maintenance measures			I	✓	✓
Explain preventative maintenance measures (e.g., lubrication)		I	R	✓	✓

Unit: Equipment Maintenance (Cont.)	10	12	AD	LL	WS
Competency: Inspect machine systems (Cont.)			I	✓	✓
Log machine histories			I	✓	✓
Explain machine system(s) calibration			I	✓	✓
Inspect linkages and lever mechanisms		I	R	✓	✓
Inspect drive couplings		I	R	✓	✓
Inspect clutches		I	R	✓	✓
Inspect roller ball bearings		I	R	✓	✓
Inspect safety systems		I	R	✓	✓
Prepare planned maintenance schedules			I	✓	✓
Explain breakdown maintenance		I	R	✓	✓
Explain reasons for keeping maintenance records		I	C	✓	✓
Explain reasons for keeping cost records		I	C	✓	✓
Competency: Perform machine maintenance			I		✓
Competency Builders:					
Use operator's and manufacturer's manuals		I	C	✓	✓
Operate individual machines		I	R	✓	✓
Diagnose malfunctions			I	✓	✓
Use lockout/tagout procedure		I	R	✓	✓
Disassemble defective section		I	C		
Clean equipment		I	C		
Repair or replace defective parts		I	R	✓	✓
Test machine for performance		I	R	✓	✓
Make minor adjustments to equipment		I	C		
Inspect machine guards		I	R	✓	✓
Replace or adjust machine guards		I	R	✓	✓
Competency: Maintain hand tools		I	R		
Competency Builders:					
Demonstrate use and care of measuring devices (e.g., rules, tapes, calipers, micrometers, multimeter, thermometer, and coordinate measuring system)		I	R	✓	✓

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Unit: Equipment Maintenance (Cont.)	10	12	AD	LL	WS
Competency: Maintain hand tools (Cont.)		I	R	✓	✓
Demonstrate use and care of equipment used to bend and assemble rigid conduit and tubing	I	R	R	✓	✓
Demonstrate use and care of common hand tools	I	C			
Demonstrate use and care of wood working tools (e.g., saws, planes, drills, hammers)	I	C			
Demonstrate use and care of sheet metal tools (e.g., sheet metal gauges, hand seamers, soldering irons)	I	C			
Demonstrate use and care of ropes, slings, pullers, and block and tackle	I	C			
Demonstrate proper metal working bench skills (including use of vices, hacksaws, files, tapes, dies, and reamers)	I	C			
Demonstrate use of care of line clearing equipment	I	R	R	✓	✓
Competency: Maintain portable power tools		I	R	✓	✓
Competency Builders:					
Demonstrate use and care of light-duty and heavy-duty drills	I	R	R	✓	✓
Demonstrate use and care of electric hammers		I	R	✓	✓
Demonstrate use and care of pneumatic drills and hammers		I	R	✓	✓
Demonstrate use and care of power screwdrivers and impact wrenches		I	R	✓	✓
Demonstrate use and care of linear motion saws		I	R	✓	✓
Demonstrate use and care of circular saws	I	R	R	✓	✓
Demonstrate use and care of routers and planes		I	R	✓	✓
Demonstrate use and care of belt, pad, and disc sanders	I	R	R	✓	✓

Unit: Equipment Maintenance (Cont.)	10	12	AD	LL	WS
Competency: Maintain portable power tools (Cont.)		I	R	✓	✓
Demonstrate use and care of grinders and shears	I	R	R	✓	✓
Demonstrate use and care of explosive actuated tools		I	R	✓	✓
Demonstrate use and care of electric lifts		I	R	✓	✓
Competency: Maintain stationary equipment		I			✓
Competency Builders:					
Demonstrate use and care of mechanical presses		I	R	✓	✓
Demonstrate use and care of hydraulic presses		I	R	✓	✓
Demonstrate use and care of drill presses		I	C	✓	✓
Demonstrate use and care of bench grinders	I	C			
Demonstrate use and care of power saws (e.g., hack, cut-off, chop, band, jig, and table)		I	R	✓	✓
Demonstrate use and care of band saws		I	R	✓	✓
Demonstrate use and care of pipe threaders		I		✓	✓
Demonstrate use and care of metal brakes		I		✓	✓
Demonstrate use and care of power shears		I		✓	✓

Unit: Mechanical Power Transmission	10	12	AD	LL	WS
Competency: Demonstrate knowledge of basic mechanics			I		
Competency Builders:					
Explain working forces of torque, tension, and compression		I	R		
Explain the laws of motion		I	R		
Explain how to calculate work		I	R		
Explain the function of simple machines including levers, inclined plane, wedge wheel and axle, pulley and screw			I		
Explain the types of power and the method of producing power including compound gears			I		
Calculate volume mathematically and by displacement			I		
Explain the laws of friction			I		
Explain mechanical efficiency			I		
Competency: Demonstrate knowledge in mechanical power transmission systems			I	✓	✓
Competency Builders:					
Describe the principles and operation of compound and reverted gear trains			I	✓	✓
Describe the principles and operation of internal and planetary gear trains			I	✓	✓
Describe the principles and operation of helical and bevel gear trains			I	✓	✓
Describe the principles and operation of rack and pinion, worm and wheel and block and screw mechanisms			I	✓	✓
Describe the principles and operation of counter rotating mechanisms and differentials			I	✓	✓
Describe the principles and operation of spring mechanisms, pulley blocks and differentials			I	✓	✓
Describe the principles and operation of chain, belt and disc drives and universal joints			I	✓	✓

Unit: Mechanical Power Transmission (Cont.)	10	12	AD	LL	WS
Competency: Demonstrate knowledge in mechanical power transmission systems (Cont.)			I	✓	✓
Describe the principles and operation of clutch and coupling mechanisms			I	✓	✓
Describe the principles and operation of braking mechanisms			I	✓	✓
Describe the necessity for proper alignment of mechanical devices			I	✓	✓
Competency: Use bearings		I	C		
Competency Builders:		I	C		
Define bearing		I	C		
Identify types of bearings and their applications		I	C		
Identify installation method		I	C		
Install bearings		I	C		
Maintain bearings		I	C		
Remove bearings		I	C		
Competency: Use seals		I	C	✓	✓
Competency Builders:		I	C	✓	✓
Define seal		I	C	✓	✓
Identify types of seals and their applications		I	C	✓	✓
Identify installation method		I	C	✓	✓
Install seals		I	C	✓	✓
Maintain seals		I	C	✓	✓
Remove seals		I	C	✓	✓
Competency: Use gears		I	R	✓	✓
Competency Builders:					
Define gears		I	C	✓	✓
Identify types of gears and their applications		I	C	✓	✓
Identify installation method		I	C	✓	✓

Unit: Mechanical Power Transmission (Cont.)	10	12	AD	LL	WS
Competency: Use gears (Cont.)		I	R	✓	✓
Install gears		I	R	✓	✓
Maintain gears		I	R	✓	✓
Remove gears		I	R	✓	✓
Competency: Use sheaves		I	R	✓	✓
Competency Builders:					
Define sheaves		I	R	✓	✓
Identify types of sheaves and their applications		I	R	✓	✓
Identify installation method		I	R	✓	✓
Install sheaves		I	R	✓	✓
Maintain sheaves		I	R	✓	✓
Remove sheaves		I	R	✓	✓
Competency: Use belts and pulleys		I	R	✓	✓
Competency Builders:					
Define belts and pulleys		I	R	✓	✓
Identify types of belts and pulleys and their applications		I	R	✓	✓
Identify installation method		I	R	✓	✓
Install belts and pulleys		I	R	✓	✓
Maintain belts and pulleys		I	R	✓	✓
Remove belts and pulleys		I	R	✓	✓
Size belts and pulleys		I	R	✓	✓
Competency: Use sprockets and chains		I	R	✓	✓
Competency Builders:					
Define sprockets and chains		I	R	✓	✓
Identify types of sprockets and chains and their applications		I	R	✓	✓
Identify installation method		I	R	✓	✓
Install sprockets and chains		I	R	✓	✓
Maintain sprockets and chains		I	R	✓	✓
Remove sprockets and chains		I	R	✓	✓
Size sprockets and chains		I	R	✓	✓

Unit: Mechanical Power Transmission (Cont.)	10	12	AD	LL	WS
Competency: Use CAMs and levers		I	R	✓	✓
Competency Builders:					
Define CAMs and levers		I	R	✓	✓
Identify types of CAMs and levers and their applications		I	R	✓	✓
Identify CAMs and levers		I	R	✓	✓
Maintain CAMs and levers		I	R	✓	✓
Remove CAMs and levers		I	R	✓	✓
Size CAMs and levers		I	R	✓	✓
Competency: Use clutches and brakes		I	R	✓	✓
Competency Builders:					
Define clutches and brakes		I	R	✓	✓
Identify types of clutches and brakes and their applications		I	R	✓	✓
Identify installation		I	R	✓	✓
Install clutches and brakes		I	R	✓	✓
Maintain clutches and brakes		I	R	✓	✓
Remove clutches and brakes		I	R	✓	✓
Size clutches and brakes		I	R	✓	✓
Competency: Install drive components		I	R	✓	✓
Competency Builders:					
Identify types of couplings and their applications		I	R	✓	✓
Identify types of belts and their applications		I	R	✓	✓
Install solid coupling		I	R	✓	✓
Install jaw coupling		I	R	✓	✓
Install molded rubber coupling		I	R	✓	✓
Install chain type coupling		I	R	✓	✓
Install a clutch		I	R	✓	✓
Install brakes		I	R	✓	✓
Align bearings, bushing, and cams		I	R	✓	✓
Install V-belts and adjust tensions		I	R	✓	✓
Install a V-belt and manually adjustable sheaves		I	R	✓	✓

Unit: Mechanical Power Transmission (Cont.)	10	12	AD	LL	WS
Competency: Install drive components (Cont.)		I	R	✓	✓
Competency Builders:					
Adjust a V-belt and manually adjustable sheaves		I	R	✓	✓
Install a V-belt with spring loaded adjustable sheaves		I	R	✓	✓
Explain the purposes and advantages of a chain drive system		I	R	✓	✓
Explain the functions of speed reducers		I	R	✓	✓
Explain the function of gears and variable speed reducers		I	R	✓	✓
Install shafts		I	R	✓	✓
Align shafts		I	R	✓	✓
Mount sheaves and pulleys		I	R	✓	✓
Mount gears on open gear drives		I	R	✓	✓
Align gears on open gear drives		I	R	✓	✓
Install a mechanical clutch system		I	R	✓	✓
Install adjustable speed drives		I	R	✓	✓
Troubleshoot adjustable speed drives		I	R	✓	✓
Explain the operation of fluid couplings		I	R	✓	✓
Install fluid couplings		I	R	✓	✓
Install torque converters		I	R	✓	✓
Perform preventative maintenance on drive components		I	R	✓	✓
Inspect completed work		I	R	✓	✓
Competency: Demonstrate proficiency in mechanisms, linkages and levers			I	✓	✓
Competency Builders:					
Describe class one, two, three, and compound levers			I	✓	✓
Describe the principles and operation of rocker arm and bell crank linkages and combined mechanisms			I	✓	✓
Describe the principles and operation of four-bar mechanisms (crank, rocker, and double rocker)			I	✓	✓

Unit: Mechanical Power Transmission (Cont.)	10	12	AD	LL	WS
Competency: Demonstrate proficiency in mechanisms, linkages and levers (Cont.)			I	✓	✓
Describe the principles and operation of drag link and intermediate mechanisms			I	✓	✓
Describe the principles and operation of four-bar variations			I	✓	✓
Describe the principles and operation of cam mechanisms		I	R	✓	✓
Describe the principles and operation of pivoted follower mechanisms			I	✓	✓
Describe the principles and operation of toggle, quick return, and ratchet mechanisms		I	R	✓	✓
Describe the principles and operation of geneva mechanisms		I	R	✓	✓
Competency: Apply lubricants			I	✓	✓
Competency Builders:					
Explain the function of lubricants		I	R	✓	✓
Explain the properties of oil lubricants and factors determining the selection of lubricants		I	R	✓	✓
Identify types and functions of lubricant additives		I	R	✓	✓
Describe types of circulating oils and their purposes		I	R	✓	✓
Describe lubricating systems, including the charts and methods used		I	R	✓	✓
Demonstrate proper grease application		I	R	✓	✓
Demonstrate proper lubricant storage and handling		I	R	✓	✓
Lubricate a piece of industrial equipment		I	R	✓	✓
Identify specified lubricant or equivalent		I	R	✓	✓
Explain lubricant recovery and disposal			I	✓	✓

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Unit: Electromechanical Power Technology	10	12	AD	LL	WS
Competency: Demonstrate proficiency in electronics fundamentals		I	R		
Competency Builders:					
Identify electronic components and schematic symbols		I	R	✓	✓
Describe basic atomic structure and its relationship to electricity	I	R	C		
Describe the relationship between electrical and magnetic properties	I	R	C		
Describe the electrical and magnetic properties of a magnet	I	R	C		
Describe the photoelectric effect	I	R	R	✓	✓
Describe the thermocouple effect		I	R	✓	✓
Describe the electrical effect of friction	I	R	C		
Use metric prefixes to solve electronic unit problems	I	R	C		
Identify sources of electricity	I	R	C		
Describe principles and operations of electrochemical supplies	I	R	R	✓	✓
Describe voltage, current, resistance, power, and energy	I	R	C		
Apply Olm's Law	I	R	C		
Apply Kirchoff's Law		I	R	✓	✓
Apply Watt's Law		I	R	✓	✓
Apply power formulas		I	R	✓	✓
Interpret color codes and symbols to identify electrical components and values		I	R	✓	✓
Measure properties of circuits using test equipment		I	C		
Describe electrostatic discharge (ESD) procedures		I	R	✓	✓

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Unit: Electromechanical Power Technology (Cont.)	10	12	AD	LL	WS
Competency: Demonstrate proficiency in reading drawings		I	R	✓	
Competency Builders:					
Describe types of drawings and their applications		I	R	✓	✓
Transfer measurements		I	R		
Describe the application of auxiliary views, revolutions, and sectional views		I	R		
Describe dimensioning practices and techniques on drawings		I	R		
Interpret production and assembly drawings		I	R		
Competency: Demonstrate knowledge of electronic sensors and transducers			I		✓
Competency Builders:					
Explain temperature transducers operation		I	R	✓	✓
Explain stress and strain transducers operation			I	✓	✓
Explain magnetic transducers operation			I	✓	✓
Explain liquid and fluid flow transducers operation			I	✓	✓
Explain fiber optic system operation			✓	✓	✓
Competency: Demonstrate proficiency in transducers (sensors) and instrumentation			I		✓
Competency Builders:					
Describe characteristics associated with transducers and instrumentation			I	✓	✓
Describe the principles and operations of various types of transducers (e.g., thermal, shock/vibration, acceleration, positional, pressure, flow, optical, gas and humidity)			I	✓	✓
Demonstrate the use of various transducers (e.g., thermal, shock/vibration, acceleration, positional, pressure, flow, optical, gas and humidity)			I	✓	✓
Troubleshoot transducers			I	✓	✓

Unit: Electromechanical Power Technology (Cont.)	10	12	AD	LL	WS
Competency: Demonstrate proficiency in transducers (sensors) and instrumentation (Cont.)			I		✓
Differentiate between thermocouple types			I		✓
Interpret specifications of temperature sensors (e.g., thermocouples, thermistors, resistance temperature devices)			I		✓
Interpret specifications of pressure sensors (e.g., strain gage, piezzo electric/piezzo resistive) to electrical circuits			I		✓
Interpret specifications of flow sensors (e.g., orifice flow meter, turbine meter, mass flow meters)			I		✓
Interpret specifications of speed of position sensor (e.g., tachometer, resolver encoder, linear voltage differential transformer (LVDT)			I		✓
Interpret specifications of controllers, indicators, and recorders (e.g., process controllers. programmable logic controllers with interfaces, R-chart recorders, data loggers/indicators			I		✓
Interpret specifications of final control elements (i.e., silicon controlled rectifiers (SCR), power controllers, motor drives, actuators/robots			I		✓
Describe application circuits			I		✓
Calculate specification of proximity sensors			I		✓
Calculate specifications of infrared and photo-sensors			I		✓
Explain use of proximity sensors			I		✓
Explain use of photo electric sensors			I		✓
Explain use of mechanically activated switches		I	R		✓
Troubleshoot switch failure			I		✓

Unit: Electromechanical Transmission (Cont.)	10	12	AD	LL	WS
Competency: Demonstrate proficiency in transducers (sensors) and instrumentation (Cont.)			I		✓
Describe transducer control and measurement circuits			I		✓
Demonstrate the use of control and measurement circuits			I		✓
Troubleshoot control and measurement circuits			I		✓
Repair control and measurement circuits			I		✓

Unit: Industrial Manufacturing Technology	10	12	AD	LL	WS
Competency: Describe industrial manufacturing process		I	R		
Competency Builders:					
Demonstrate use and maintenance of personal protective equipment		I	R		
Explain techniques of measuring motion, forces, voltage, current, power, distances, time and temperature		I	R		
Explain mechanical properties of ferrous and non-ferrous metals		I	R		
Explain industrial manufacturing process		I	R		
Explain industrial use of non-metallic solids (e.g., ceramics, polymers), liquids, and gases		I	R		
Develop flow chart and process sheets		I	R		
Draft preventative maintenance and calibration procedures		I	R		
Explain need for manufacturing documentation		I	R		
Competency: Demonstrate knowledge of manufacturing a quality product		I	R		
Competency Builders:					
Juxtapose customer satisfaction with product characteristics (e.g., usefulness, price, operation, life, reliability, safety, cost of operation)		I	R		
Define manufacturability		I	R		
Identify steps in product design (e.g., brainstorming, thumbnail sketches, rendering)		I	R		
Define reliability factors (e.g., cost, human producability)		I	R		
Identify ways reliability is achieved (e.g., maintainability, good design, design simplification, design redundancy)		I	R		
Explain the relationship of maintainability to reliability		I	R		
Define reproducibility and repeatability		I	R		

Unit: Industrial Manufacturing Technology (Cont.)	10	12	AD	LL	WS
Competency: Demonstrate knowledge of manufacturing a quality product (Cont.)		I	R		
Explain the role of testing and reliability		I	R		
Define value engineering		I	R		
Define quality objectives		I	R		
Identify cost components as they relate to quality objectives		I	R		
Classify quality costs (i.e., preventative, evaluation, pre-delivery failures, post delivery failures)		I	R		
Explain predictive maintenance		I	R		
Define "cost and quality"		I	R		
Analyze quality cost reports		I	R		
Competency: Complete a manufacturing project		I	C		
Competency Builders:					
Explain project selection		I	C		
Explain project implementation		I	C		
Explain project evaluation		I	C		
Explain continuing improvement		I	C		
Describe future trend of design of experiments		I	C		
Describe future trend of predictive maintenance		I	C		

Unit: Basic Machining	10	12	AD	LL	WS
Competency: Perform prerequisite machining skills		I	R	✓	
Competency Builders:					
Demonstrate proficiency in maintaining immediate work area, machinery, and tools	I	R	C	✓	✓
Demonstrate proficiency in reading blueprints/drawings		I	R	✓	✓
Demonstrate proficiency in planning work sequence		I	R	✓	✓
Follow safety rules and regulations	I	R	C		
Competency: Analyze machine shop job			I	✓	✓
Competency Builders:					
Identify sequence of work on specified project(s)			I	✓	✓
Identify tolerances and finishes on specified project(s)			I	✓	✓
Identify variables that effect job efficiency			I	✓	✓
Explain use of the Machinery Handbook			I	✓	✓
Competency: Achieve job standards			I	✓	✓
Competency Builders:					
Write job description(s)			I	✓	✓
Complete job status report(s)			I	✓	✓
Analyze job evaluation data			I	✓	✓
Competency: Select materials		I	R	✓	✓
Competency Builders:					
Interpret color codes, numbering systems, and classification systems of materials (i.e., AISI, SAE)		I	R	✓	✓
Select material for job		I	R	✓	✓
Identify metals using variety of tests		I	R	✓	✓
Identify materials		I	R	✓	✓

Unit: Basic Machining (Cont.)	10	12	AD	LL	WS
Competency: Perform heat treatment of metals		I	R	✓	✓
Competency Builders:					
Test hardness of metals	I	R	C	✓	✓
Perform non-destructive testing		I	R	✓	✓
Perform destructive testing		I	R	✓	✓
Harden metals to job specifications		I	R	✓	✓
Temper metals to job specifications		I	R	✓	✓
Anneal metals to job specifications		I	R	✓	✓
Normalize metals to job specifications		I	R	✓	✓
Case harden metals to job specifications		I	R	✓	✓
Competency: Demonstrate basic knowledge of nontraditional machining processes			I		✓
Competency Builders:					
Describe principles of chemical etching			I	✓	✓
List applications of chemical etching			I	✓	✓
List advantages/disadvantages of chemical etching			I	✓	✓
Describe principles of photochemical etching			I	✓	✓
List applications of photochemical etching			I	✓	✓
List advantages/disadvantages of photochemical etching			I	✓	✓
Describe electrical-discharge machining (EDM)			I	✓	✓
List applications of EDM			I	✓	✓
Differentiate between EDM and wire EDM			I	✓	✓
List applications for wire EDM			I	✓	✓
Describe principles of electrochemical machining			I	✓	✓
List applications of electrochemical machining			I	✓	✓
List advantages/disadvantages of electrochemical machining			I	✓	✓

Unit: Basic Machining (Cont.)	10	12	AD	LL	WS
Competency: Demonstrate basic knowledge of nontraditional machining processes (Cont.)			I		✓
Describe principles of water jet cutting			I	✓	✓
List advantages of water jet cutting			I	✓	✓
Describe principles of torch cutting		I	R	✓	✓
List applications of torch cutting		I	R	✓	✓
Describe principles of laser cutting			I	✓	✓
List applications of laser cutting			I	✓	✓
List advantages/disadvantages of laser cutting			I	✓	✓
Describe principles of plasma arc cutting			I	✓	✓
List applications of plasma arc cutting			I	✓	✓
Competency: Inspect part			I	✓	✓
Competency Builders:					
Identify appropriate tools for measuring	I	R	C	✓	✓
Describe precision, accuracy, tolerance, reliability, and discrimination		I	R	✓	✓
Distinguish between precision and semiprecision measuring			I	✓	✓
Define standard stock dimensions and tolerances			I	✓	✓
Describe common measurement errors and correction procedures			I	✓	✓
Calibrate measuring machines and devices		I	R	✓	✓
Demonstrate care of measuring instruments		I	R	✓	✓
Demonstrate use of rule	I	R	C	✓	✓
Demonstrate use of tape	I	R	C	✓	✓
Demonstrate use of pi tape			I	✓	✓
Demonstrate use of combination square	I	R	C		
Demonstrate use of calipers	I	R	C		
Demonstrate use of micrometers	I	R	C		

Unit: Basic Machining (Cont.)	10	12	AD	LL	WS
Competency: Inspect part (Cont.)			I	✓	✓
Demonstrate use of dial indicators		I	R	✓	✓
Demonstrate use of sine bar			I	✓	✓
Demonstrate use of gauges		I	R	✓	✓
Demonstrate use of surface plate		I	R	✓	✓
Demonstrate use of protractor	I	R	C		
Demonstrate use of profilometer			I	✓	✓
Demonstrate use of thermometer	I	R	C		
Demonstrate use of dividers	I	R	C		
Demonstrate use of gauge blocks		I	R	✓	✓
Demonstrate use of threading specs		I	R	✓	✓
Demonstrate use of optical comparitor			I	✓	✓
Demonstrate use of digital instruments		I	R	✓	✓
Demonstrate use of electronic gauging equipment			I	✓	✓
Demonstrate use of data acquisition equipment			I	✓	✓
Operate manual coordinate measuring machine			I	✓	✓
Explain use and application of laser alignment/measurement			I	✓	✓

Unit: Hydraulics and Pneumatics	10	12	AD	LL	WS
Competency: Explain fluid flow concepts			I		
Competency Builders:					
Explain Pascal's Law		I	R		✓
Explain Boyle's Law		I	R		✓
Explain Bernoulli's Principle		I	R		✓
Describe flow velocity			I		✓
Explain how heat and pressure relate to power and transmission		I	R		✓
Describe physical and chemical properties of a fluid		I	R		✓
Describe fluids in motion in closed conductors		I	R		✓
Describe continuity of mass flow		I	R		✓
Identify types of fluids		I	R		✓
Identify properties of fluids		I	R		✓
Identify units of measurement for pressure, density, and viscosity		I	R		✓
Competency: Describe energy considerations			I		
Competency Builders:					
Differentiate work and power		I	C	✓	✓
Differentiate potential and kinetic energy		I	R	✓	✓
Explain energy conservation concept		I	R	✓	✓
Explain hydraulic horsepower			I	✓	✓
Explain work of compression in compressible fluids			I	✓	✓
Competency: Describe system losses			I	✓	
Competency Builders:					
Differentiate turbulent and laminar flow			I	✓	✓
Explain friction factor			I	✓	✓
Explain pressure losses			I	✓	✓
Identify potential system losses (e.g., leaks, wear, component sizing, dirt)			I	✓	✓

Unit: Hydraulics and Pneumatics (Cont.)	10	12	AD	LL	WS
Competency: Explain hydrostatics		I	R		
Competency Builders:					
Explain pressure, density, and viscosity		I	R		
Explain buoyancy	I	R	C		
Explain equilibrium		I	R		
Competency: Calculate energy			I		
Competency Builders:					
Apply Pascal's Law			I	✓	✓
Apply Bernoulli's Principle			I	✓	✓
Apply Boyle's Law			I	✓	✓
Calculate work and power			I	✓	✓
Calculate potential and Kinetic energy			I	✓	✓
Calculate hydraulic horsepower			I	✓	✓
Calculate flow velocity and pressure			I	✓	✓
Calculate pressure losses			I	✓	✓
Calculate laminar flow			I	✓	✓
Calculate pump capacity			I	✓	✓
Calculate system requirements			I	✓	✓
Competency: Design basic hydraulic/pneumatic system			I		✓
Competency Builders:					
Use common symbols			I	✓	✓
Create circuit diagrams (i.e., schematics)			I	✓	✓
Diagram closed-loop hydraulic system			I	✓	✓
Diagram an air supply system			I	✓	✓
Competency: Explain component operation			I		
Competency Builders:					
Identify functions and operation of hydraulic components			I	✓	✓
Identify functions and operation of pneumatic components			I	✓	✓
Explain application(s) of different materials (e.g., plastic, copper)			I	✓	✓

Unit: Hydraulics and Pneumatics (Cont.)	10	12	AD	LL	WS
Competency: Troubleshoot hydraulic and pneumatic circuits			I		
Competency Builders:					
Analyze hydraulic circuits			I	✓	✓
Troubleshoot hydraulic circuits			I	✓	✓
Analyze pneumatic circuits			I	✓	✓
Troubleshoot pneumatic circuits			I	✓	✓
Competency: Perform pump maintenance and repair			I		✓
Competency Builders:					
Identify pump capacity and system requirements			I	✓	✓
Explain packing and seal requirements			I	✓	✓
Explain operating principles of pumps (e.g., centrifugal, propeller and turbine rotary, metering)			I	✓	✓
Perform pump maintenance			I	✓	✓
Disassemble a pump			I	✓	✓
Reassemble a pump			I	✓	✓
Competency: Maintain piping and accessories for high and low pressure fluid power systems			I		✓
Competency Builders:					
Identify components of a piping system			I	✓	✓
Explain maintenance features of both metallic and non-metallic piping systems			I	✓	✓
Explain types of values and their operation and maintenance			I	✓	✓
Explain use and maintenance of strainers, filters, and traps in piping systems			I	✓	✓
Join common fittings			I	✓	✓
Join metallic pipe			I	✓	✓
Join plastic pipe			I	✓	✓
Join copper and steel tubing			I	✓	✓
Bend copper and steel tubing			I	✓	✓
Cut copper and steel tubing			I	✓	✓

Unit: Hydraulics and Pneumatics (Cont.)	10	12	AD	LL	WS
Competency: Maintain hydraulic system components			I		✓
Competency Builders:					
Explain how heat and pressure relate to power and transmission			I	✓	✓
Describe physical and chemical properties of a fluid		I	R	✓	✓
Install a contaminant removal system			I	✓	✓
Maintain a contaminant removal system			I	✓	✓
Explain operation and use of heat exchanges			I	✓	✓
Identify reservoir requirements			I	✓	✓
Select pumps for specific applications			I	✓	✓
Compute hose requirements			I	✓	✓
Install hydraulic lines			I	✓	✓
Select control valves and servo-type values			I	✓	✓
Install control values and servo-type values			I	✓	✓
Competency: Troubleshoot hydraulic systems			I		✓
Competency Builders:					
Interpret hydraulic schematic			I	✓	✓
Connect electrically controlled values			I	✓	✓
Explain hydraulic system troubleshooting techniques			I	✓	✓
Repair or replace hydraulic cylinders			I	✓	✓
Repair or replace hydraulic pumps and motors			I	✓	✓
Install hydraulic components			I	✓	✓
Competency: Describe reciprocating and rotary air compressors			I		✓
Competency Builders:					
Explain relationship of force, weight, mass, and density in pneumatic system		I	R	✓	✓
Explain operation of reciprocating compressors			I	✓	✓

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Unit: Hydraulics and Pneumatics (Cont.)	10	12	AD	LL	WS
Competency: Describe reciprocating and rotary air compressors (Cont.)			I		✓
Explain operation of rotary compressors			I	✓	✓
Explain primary and secondary air treatment (e.g., air dryers, lubricating systems)			I	✓	✓
Explain operation of compressor values, cylinders, and motors			I	✓	✓
Competency: Maintain pneumatic systems			I		✓
Competency Builders:					
Install pneumatic system components			I	✓	✓
Explain pneumatic system maintenance techniques			I	✓	✓
Explain pneumatic system troubleshooting procedures			I	✓	✓
Isolate faults in air compressors			I	✓	✓
Repair or replace air compressors			I	✓	✓
Isolate faults in control valves			I	✓	✓
Repair or replace control valves			I	✓	✓
Isolate faults in air motors			I	✓	✓
Repair or replace air motors			I	✓	✓
Isolate faults in air dryers			I	✓	✓
Repair or replace air dryers			I	✓	✓
Maintain proportioning and servo valves			I	✓	✓
Competency: Troubleshoot pneumatic systems			I		✓
Competency Builders:					
Identify the schematic symbols and diagrams used in pneumatic systems			I	✓	✓
Diagram an air supply system			I	✓	✓
Install pneumatic system components			I	✓	✓
Explain pneumatic system troubleshooting procedures			I	✓	✓
Troubleshoot air compressors			I	✓	✓

Unit: Hydraulics and Pneumatics (Cont.)	10	12	AD	LL	WS
Competency: Troubleshoot pneumatic systems (Cont.)			I		✓
Troubleshoot pneumatic control valves			I	✓	✓
Troubleshoot air motors			I	✓	✓
Troubleshoot air dryers			I	✓	✓
Competency: Maintain vacuum systems			I		✓
Competency Builders:					
Describe characteristics associated with vacuum systems and sub-atmospheric pressure		I	R	✓	✓
Describe the principles and operation of vacuum gauges			I	✓	✓
Demonstrate use of vacuum gauges			I	✓	✓
Repair or replace vacuum gauges			I	✓	✓
Describe the principles and operation of vacuum pumps			I	✓	✓
Demonstrate use of vacuum pumps			I	✓	✓
Repair or replace vacuum pumps			I	✓	✓
Describe the principles and operation of vacuum controls			I	✓	✓
Demonstrate the use of vacuum controls			I	✓	✓
Repair or replace vacuum controls			I	✓	✓

Unit: Production Planning and Control	10	12	AD	LL	WS
Competency: Demonstrate knowledge of materials requirements planning		I	R		✓
Competency Builders:					
Define materials requirements planning		I	R	✓	✓
Explain importance of maintaining and controlling inventory (e.g., quantity, price, quality, minimal lot sizes, and timeliness)		I	R		
Define master production schedule and bill of materials		I	R		✓
Explain inventory carrying cost and economic order quantity		I	R		✓
Describe the use of the computer in MRP		I	R		✓
Describe relationship of master production schedule and bill of materials		I	R		✓
Describe outputs from MRP (i.e., material requirements, dates)		I	R		✓
Calculate net requirements		I	R		✓
Explain importance of forecast production planning based on historical usage		I	R		✓
Competency: Demonstrate knowledge of JIT					✓
Competency Builders:					
Define just-in-time concept (JIT)		I	R		✓
Describe various production methodologies (e.g., standard cycle times, routings, standard quantities, multiple-machine tending)		I	R		✓
Describe types of replenishing systems (e.g.,Kanban)		I	R		✓
Competency: Demonstrate knowledge of supply materials		I	R		✓
Competency Builders:					
Describe role of purchase requisitions		I	R		✓
Describe role of material specifications		I	R		✓
Describe role of quality parameters		I	R		✓

Unit: Production Planning and Control (Cont.)	10	12	AD	LL	WS
Competency: Demonstrate knowledge of supply materials (Cont.)					
Define supplier certification rating methods		I	R		✓
Describe role of source inspector		I	R		✓
Describe role of receiving		I	R		✓
Competency: Demonstrate knowledge of plant layouts		I	R		✓
Describe the importance of flexibility		I	R		✓
Differentiate among layout, process layout, fixed position layout, and cellular layout		I	R		✓
Describe the production suited to each layout		I	R		✓
Describe advantages/disadvantages of each layout		I	R		✓
Competency: Demonstrate knowledge of material flow materials		I	R		✓
Competency Builders:					
Differentiate among straight line, U-shaped, convoluted, and comb patterns		I	R		✓
Describe the production suited to each pattern		I	R		✓
Describe advantages/disadvantages of each pattern		I	R		✓
Draw flow diagrams of each pattern		I	R		✓
Competency: Demonstrate knowledge of post-production control		I	R		✓
Competency Builders:					
Explain importance of product protection, identification and storage		I	R		✓
List methods of identifying products (e.g., labels, bar codes, radio frequency systems and magnetic strip systems)		I	R		✓

Unit: Production Planning and Control (Cont.)	10	12	AD	LL	WS
Competency: Demonstrate knowledge of post-production control (Cont.)		I	R		✓
Describe manual methods of storage and retrieval		I	R		✓
Describe automated storage and retrieval systems (ASRS)		I	R		✓
Describe automated guided vehicle moving systems (AGVS)		I	R		✓

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Unit: Industrial Engineering Basics	10	12	AD	LL	WS
Competency: Demonstrate knowledge of workstation design			I	✓	
Competency Builders:			I	✓	
Participate in development of overall plant layout			I	✓	
Assure minimal movement of materials and parts throughout production line			I	✓	
Plan operator's access to materials and tools			I	✓	
Assure operator never reaches across moving machine part			I	✓	
Eliminate unnecessary body moves (e.g., bends, turns, stoops, hand movements)			I	✓	
Assure physical safety of operator (e.g., equipment, temperature, fumes, light)			I	✓	
List types of material handling equipment for operation			I	✓	
Calculate bench space needs for process and storage			I	✓	
Calculate machine controls to position operator efficiently			I	✓	
Physically simulate operation			I	✓	
Review total process for simplification			I	✓	
Explain cellular manufacturing			I	✓	
Prepare flow charts			I	✓	
Competency: Demonstrate knowledge of ergonomics			I	✓	
Competency Builders:					
Define ergonomics			I	✓	
Define risk factor			I	✓	
Define maximum permissible limit (MPL) and action limit (AL) for lifting			I	✓	
Define cumulative trauma disorder (CTD)			I	✓	
Minimize extreme joint movement			I	✓	
Minimize use of excessive muscle force			I	✓	

Unit: Industrial Engineering Basics (Cont.)	10	12	AD	LL	WS
Competency: Demonstrate knowledge of ergonomics (Cont.)			I		
Minimize repetitive tasks			I		
Minimize mechanical stresses (e.g., sharp edges, heat, cold, hard surfaces, weights, vibration)			I		
Minimize awkward body positions			I		
Identify need for mats and footrest for standing jobs			I		
Identify need for appropriate working heights of chairs, stools, workbenches, and equipment			I		
Explain use of anthropometric design			I		
Explain use of rest pauses			I		
Identify susceptibility factors for CTD			I		
Competency: Demonstrate knowledge of methods			I	✓	
Competency Builders:					
Define methods engineering			I	✓	
Define goals of methods engineering (i.e., quality, increase productivity, decrease per unit cost)			I	✓	
Set sequence of production operations			I	✓	
Set sequence of needed inspections			I	✓	
Recommend methods to shorten process time			I	✓	
Recommend alternate operations			I	✓	
Recommend ways to eliminate operations			I	✓	
Ascertain if operations can be performed within facilities			I	✓	✓
Test machine capability			I		
Follow documentation procedures			I		

Unit: Industrial Engineering Basics (Cont.)	**10**	**12**	**AD**	**LL**	**WS**
Competency: Demonstrate knowledge of standards engineering	▨	▨	I	✓	▨
Competency Builders:					
Estimate times by computer simulation			I	✓	
Use predetermined time systems (e.g., MTM family, time study)			I	✓	
Define reach, grasp, move position, turn, apply pressure, and release			I	✓	
Use work sampling			I	✓	
Define standard time			I	✓	
Define leveling factors (e.g., skill levels, effort, work area conditions, consistency)			I	✓	
List allowance factors (e.g., fatigue, delay, personal)			I	✓	
Define allowances			I	✓	
Calculate production rate			I	✓	
Write job description data			I	✓	
Complete job status reports			I	✓	
Analyze job evaluation data			I	✓	
Competency: Examine cost control	▨	▨	I	▨	▨
Competency Builders:					
Develop cost control data			I		
Analyze cost control reports			I		
Provide cost control data			I		
Provide advice on "Make or Buy" decisions (including economical lot size decisions)			I		
Competency: Demonstrate knowledge of material flow	▨	▨	I	✓	▨
Competency Builders:					
Describe importance of flexibility			I	✓	
Differentiate product layout, process layout, fixed position layout, and cellular layout			I	✓	
Differentiate straight-line, U-shaped, convoluted and comb patterns			I	✓	

Unit: Industrial Engineering Basics (Cont.)	10	12	AD	LL	WS
Competency: Demonstrate knowledge of material flow (Cont.)			I	✓	
Describe advantages/disadvantages of layout and patterns			I	✓	
Prepare flow charts			I	✓	
Competency: Maintain quality control and materials handling			I	✓	
Competency Builders:					
Maintain system for physical handling and movement of material in-process and in-storage			I		
Monitor system of physical handling and movement of material in-process and in-storage			I		
Maintain system for physical handling and movement of finished products			I		
Monitor system of physical handling and movement of finished products			I		
Write requests for deviation from specifications			I		
Implement quality control and inspection standards and procedures			I		
Write engineering change notices and rejection reports			I		
Monitor reports of discrepancy or rejects during production process			I		
Conduct quality tests under different environmental conditions			I		

Unit: Computerized Numerical Control (CNC)	**10**	**12**	**AD**	**LL**	**WS**
Competency: Demonstrate knowledge of CNC			I	✓	✓
Competency Builders:					
Define NC and CNC		I	R	✓	✓
Explain differences of NC and CNC		I	R	✓	✓
Describe closed loop, open loop, and adaptive controls			I	✓	✓
Define point to point systems		I	R	✓	✓
Identify tool movement of point to point systems		I	R	✓	✓
Define continuous path systems		I	R	✓	✓
Identify tool movement of continuous path systems		I	R	✓	✓
Identify data input mediums		I	R	✓	✓
Explain the purpose of the post-processor			I	✓	✓
Define canned cycles		I	R	✓	✓
Identify computer memory types		I	R	✓	✓
Identify information stored relative to computer memory types		I	R	✓	✓
Explain the difference between hardware and software	I	R	C		
Explain differences among CNC, machining centers, and robots		I	R	✓	✓
List advantages/disadvantages of CNC machining centers		I	R	✓	✓
Explain direct numerical control (DNC)		I	R	✓	✓
Competency: Apply CNC operations		I	R	✓	✓
Competency Builders:					
Identify parts of the machine	I	R	C		
Apply basic programming skills to a turning and/or a milling operation		I	R	✓	✓
Select proper work holders		I	R	✓	✓
Select proper cutting tools		I	R	✓	✓
Set machine parts to drawing tolerances		I	R	✓	✓
Demonstrate use of CAD/CAM for part program development		I	R	✓	✓
Select proper programming parameters (e.g., speeds, feeds)		I	R	✓	✓

Unit: Computerized Numerical Control (CNC) (Cont.)	**10**	**12**	**AD**	**LL**	**WS**
Competency: Prepare program		I	R	✓	✓
Competency Builders:					
Write a program manually in word address format		I	R	✓	✓
Write a program off line		I	R	✓	✓
Write a program manually in conversational program		I	R	✓	✓
Generate a program using CAD/CAM package		I	R	✓	✓
Program machine using manual data input (MDI) process		I	R	✓	✓
Competency: Program CNC operations		I	R	✓	✓
Competency Builders:					
Apply ANSI drawing standards		I	R	✓	✓
Perform process planning from drawing to finished product			I	✓	✓
Analyze workpiece			I	✓	✓
Contrast differences in computer assisted programming			I	✓	✓
Perform basic trigonometric computations		I	R	✓	✓
Establish chip load, feed rates and surface feet per minute limitations		I	R	✓	✓
Turn intersection points into segments (i.e., defined in terms of points, lines, and circles)		I	R	✓	✓
Debug program		I	R	✓	✓
Competency: Load machine		I	R	✓	
Competency Builders:					
Load program from MDI and off-line programming station		I	R	✓	✓
Prepare work-holding device		I	C		
Secure workpiece		I	C		
Set up reference and clearance points		I	R	✓	✓
Set up tooling		I	R	✓	✓

Unit: Computerized Numerical Control (CNC) (Cont.)	10	12	AD	LL	WS
Competency: Operate CNC machine		I	R	✓	
Competency Builders:					
Load raw material		I	C		
Start cycle		I	C		
Monitor work in-process		I	R	✓	✓
Edit CNC programs		I	R	✓	✓
Perform operator/preventative maintenance		I	R	✓	✓

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JC: 03/12/96 UPDATE

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Machine Tool, Die and Moldmaking Technology

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Unit: Workplace Safety	10	12	AD	LL	WS
Competency: Apply general safety precautions	I	R	R		✓
Competency Builders:					
Follow local, state, and federal rules and regulations	I	R	R		
Identify personal protective wear and equipment	I	R	R		
Use personal protective wear and equipment	I	R	R		
Apply workplace safety rules and procedures	I	R	R		✓
Apply personal safety rules and procedures	I	R	R		
Apply proper handling techniques	I	R	R		
Apply proper lifting techniques	I	R	R		
Apply workplace organization (e.g., housekeeping)	I	R	R		
Apply electrical, mechanical, steam, hydraulic and pneumatic safety rules and procedures	I	R	R		
Apply fire safety rules and procedures, including extinguishers and classes of fires	I	R	R		
Apply hazardous wastes rules and procedures	I	R	R		✓
Apply basic first aid and CPR procedures	I	R	R		
Describe corrective procedures for unsafe conditions	I	R	R		
Identify visual controls (e.g., monitors, read outs)	I	R	R		
Identify auditory controls	I	R	R		
Perform lockout and tagout	I	R	R		✓
Practice lockout and tagout	I	R	R		
Practice good personal hygiene	I	R	R		
Clean work area	I	R	R		
Define cumulative trauma disorder (CTD)	I	R	R		

Unit: Workplace Safety (Cont'd.)	10	12	AD	LL	WS
Competency: Apply general safety precautions (Cont'd.)	I	R	R		✓
Identify susceptibility factors for CTD	I	R	R		
Competency: Demonstrate knowledge of workplace hazards	I	R	R		
Competency Builders:	I	R	R		
Identify types of workplace hazards (e.g., physical hazards, fire, chemicals, noise, ionizing radiation, ultraviolet, temperature extremes, ergonomics, biological hazards)	I	R	R		
Interpret hazardous materials notices on containers	I	R	R		
Locate Material Safety Data Sheets (MSDS)	I	R	R		
Read Material Safety Data Sheets (MSDS)	I	R	R		
Interpret Material Safety Data Sheets (MSDS)	I	R	R		
Explain purpose(s) of OSHA and NIOSH	I	R	R		
Explain purpose(s) of NEC and NFPA	I	R	R		
Identify purpose of emergency evacuation routes, master switch and lockout locations, and safety color coding systems	I	R	R		
Describe methods of evaluating potential hazards (e.g., visual analysis)	I	R	R		
Describe methods of correcting potential hazards	I	R	R		
Describe various types of toxicity (e.g., chronic, immediate)	I	R	R		
Identify information needed for reporting accidents	I	R	R		
Explain precautions required when using toxic or flammable materials	I	R	R		
Define confined space and related requirements	I	R	R		
Follow emergency organization plan	I	R	R		

Unit: Workplace Safety (Cont'd.)	10	12	AD	LL	WS
Competency: Demonstrate knowledge of workplace hazards (Cont'd.)	I	R	R		
Explain basics of worker's compensation	I	R	R		
Competency: Describe safe use of materials handling	I	R	R		
Competency Builders:					
Describe proper use of fork lifts	I	R	R		✓
Describe proper use of manual lifts	I	R	R		✓
Describe proper use of electric hoists	I	R	R		✓
Describe proper use of manual hoists	I	R	R		✓
Competency: Explain purpose of industrial pollution control systems	I	R	R		✓
Competency Builders:					
Describe types of air, water, solid waste, and noise pollution	I	R	R		✓
Explain purpose of air pollution control systems	I	R	R		✓
Explain purposes of water pollution control systems	I	R	R		✓
Explain purpose of solid waste pollution control systems	I	R	R		✓
Explain purpose of noise pollution control systems	I	R	R		✓
Explain basic philosophy of "right to know" legislation	I	R	R		✓
Explain purpose(s) of EPA	I	R	R		✓
Describe proper recycling of scrap metal, chips, shavings, coolants, solvents, trash, and waste materials	I	R	R		✓
Describe how recycling affects air, water, solid waste, and noise pollution control systems	I	R	R		✓

Unit: Quality Assurance	10	12	AD	LL	WS
Competency: Demonstrate knowledge of quality assurance		I	R		✓
Competency Builders:					
Explain the historical evolution of quality assurance (e.g., Demming, ISO 9000)		I	R		
Define quality terms		I	R		
Define quality functions		I	R		
Identify features of quality planning		I	R		
Describe control devices used in functional areas (e.g., SPC, equipment)		I	R		
Explain the relationship among organizational structures, policies, procedures, and quality assurance		I	R		
Explain importance of internal and external customers		I	R		
Identify internal and external customers		I	R		
Explain importance of interdepartmental relationships		I	R		
Describe successful efforts by industry to improve quality and/or reduce costs		I	R		
Differentiate prevention and detection		I	R		
Differentiate variable and attribute data		I	R		
Identify types of charts		I	R		
Explain how statistical techniques are tools used to control quality		I	R		
Competency: Demonstrate knowledge of quality costs and implications			I		✓
Competency Builders:					
Identify cost/quality objectives			I		
Differentiate convergent and divergent thinking			I		
Classify costs (i.e., direct and indirect, fixed and variable, methods and standards)		I	R		

Unit: Quality Assurance (Cont'd.)	10	12	AD	LL	WS
Competency: Demonstrate knowledge of quality costs and implications (Cont'd.)			I		
Classify quality costs (i.e., prevention, evaluation, pre-delivery failures, post-delivery failures)			I		
Define product liability		I	R		
Explain consumerism and liability prevention		I	R		
Define safety terms of product		I	R		
Identify safety responsibility within organization		I	R		
Differentiate contracts and torts		I	R		
Differentiate express and implied warranty		I	R		
Explain how warranties are part of contract law		I	R		
List questions that would need answering in a liability claim		I	R		
Competency: Explain importance of interdepartmental relationships to quality assurance			I		✓
Competency Builders:					
Explain how quality assurance philosophy has changed in recent years			I		
Explain need for everyone's commitment in assuring quality			I		
Explain phrase "Everyone is a customer/supplier"			I		
Define quality improvement team models			I		
Explain project selection			I		
Explain project implementation			I		
Explain project evaluation			I		
Explain continuing improvement			I		
Describe future trends of experiment design			I		
Describe future trends of predictive maintenance			I		
Competency: Demonstrate knowledge of basic statistics		I			
Competency Builders:					
Select data collection methods		I			

Unit: Quality Assurance (Cont'd.)	10	12	AD	LL	WS
Competency: Demonstrate knowledge of basic statistics (Cont'd.)		I			
Collect data		I			
Organize data by flow chart		I			
Organize data by cause and effect diagrams		I			
Define nominal, ordinal, interval, and ratio data		I			
Explain differences of random sampling methods		I			
Develop parieto chart		I			
Define mean, median, and mode		I			
Construct histogram		I			
Interpret histogram		I			
Compute standard deviation		I	C		
Explain significance of standard deviation		I	C		
Develop run chart		I	C		
Explain normal distribution		I	C		
Define "in-control process"		I	C		
Competency: Demonstrate knowledge of scattergrams			C		
Competency Builders:			C		
Construct scattergrams			C		
Interpret for positive, negative, or no correlation between X and Y variables			C		
Test for significance between one and five percent			C		
Competency: Demonstrate knowledge of probability theory		I	R		✓
Competency Builders:					
Define classical probability		I	R		
Define empirical probability		I	R		
Calculate probability for outcomes		I	R		

Unit: Quality Assurance (Cont'd.)	10	12	AD	LL	WS
Competency: Demonstrate knowledge of precontrol		I	R		✓
Competency Builders:					
Explain uses of precontrol		I	R		
Calculate precontrol limits		I	R		
Explain significance of the limits		I	R		
Plot values on a precontrol chart		I	R		
Explain "out-of-control" situation		I	R		
Make decisions on green, yellow and red conditions		I	R		
Competency: Demonstrate knowledge of process capability		I	C		
Competency Builders:		I	C		
Use X, R, USL, and LSL to determine process capability (upper and lower specification limits)		I	C		
Calculate estimated process standard deviation		I	C		
Plot right hand and left hand tail of process variation		I	C		
Compute Z value for percent of probable defect for process		I	C		
Calculate C_pK values that describe process capability		I	C		
Describe skewed distributions		I	C		
List probable causes of skewed distribution		I	C		
Competency: Use quality control charts		I	R		✓
Competency Builders:					
Identify operational definitions for attribute criteria		I	R		✓
Interpret X and R chart		I	R		✓
Interpret histogram		I	R		✓
Interpret scattergrams		I	R		✓
Interpret NP chart		I	R		✓
Interpret P chart		I	R		✓

Unit: Quality Assurance (Cont'd.)	10	12	AD	LL	WS
Competency: Use quality control charts (Cont'd.)		I	R		✓
Interpret flowchart		I	R		✓
Interpret cause-and-effect diagram		I	R		✓
Construct P (percentage defective) chart for attributes		I	R		✓
Plot control limits of P chart and data points		I	R		✓
Check chart for out-of-control conditions		I	R		✓
Construct an NP (number defective) chart with control limits and data		I	R		✓
Construct C (count of defects) and U (number of defects per unit) charts		I	C		
Construct flowchart		I	C		
Construct cause-and-effect chart		I	C		
Competency: Interpret X and R charts		I	C		
Competency Builders:					
Plot percentages for normal distribution		I	C		
Test distribution for normality		I	C		
Explain difference between common cause and special cause		I	C		
Explain significance of an out-of-control point on X or R chart		I	C		
Identify patterns and trends on control chart		I	C		
Identify run up and run down		I	C		
Test for middle third on control chart		I	C		
Explain significance of middle third on control chart		I	C		
Explain Rule of Sevens		I	C		

Unit: Quality Assurance (Cont'd.)	10	12	AD	LL	WS
Competency: Construct X and R charts		I	C		
Competency Builders:					
Arrange data into statistical subgroups		I	C		
Explain importance of random sampling		I	C		
Compute X (i.e., average of values) and R (i.e., range of values in subgroup) within sample		I	C		
Plot in X and R on chart		I	C		
Construct control chart with X (grand average) and R (average range) calculated		I	C		
Calculate upper and lower control limits for X-chart		I	C		
Calculate upper and lower control limits for R-chart		I	C		
Competency: Conduct process improvement studies		I	R		✓
Competency Builders:					
Analyze production methods and processes applying statistical process improvement techniques (e.g., SPC, C_pK)		I	R		
Identify appropriate statistical techniques for study (e.g., T-tests, F-tests, capability, DOEX)		I	R		
Identify major steps in conducting a study		I	R		
Define "report" for a study (e.g., goal, objective, study conduct, results, conclusions, discussions)		I	R		
Integrate results into the total system		I	R		
Competency: Demonstrate knowledge of inspection	I	R	C		
Competency Builders:					
Explain purpose of inspection	I	R	C		
Describe scope of inspection	I	R	C		

Unit: Quality Assurance (Cont'd.)	**10**	**12**	**AD**	**LL**	**WS**
Competency: Demonstrate knowledge of inspection (Cont'd.)	I	R	C		
Explain purpose of incoming, ongoing, and final inspections	I	R	C		
Explain early detection inspection	I	R	C		
Explain how statistical process control (SPC) aids inspection	I	R	C		
Define types of nonconformance	I	R	C		
Define degrees of nonconformance	I	R	C		
Define corrective action	I	R	C		
Describe when to 100% inspect	I	R	C		
Describe when to sample inspect	I	R	C		
Describe methods of testing for material properties (e.g., harness, strength, chemical makeup, flaws, errors in tooling or setup)	I	R	C		
Define rework, salvage, and scrap	I	R	C		
Describe ethical decisions an inspector may make	I	R	C		
Identify purposes of computer-automated inspection	I	R	C		
Explain advantages and limitations of automated inspection	I	R	C		
Competency: Inspect machinery, materials, and products		I	R		✓
Competency Builders:					
Identify critical material characteristics from specification(s) or drawing(s)		I	R		
Perform capability studies for machinery and materials acceptance		I	R		
Identify appropriate acceptance sampling plan		I	R		
Conduct incoming materials inspection using sampling plan criteria		I	R		

Unit: Quality Assurance (Cont'd.)	10	12	AD	LL	WS
Competency: Inspect machinery, materials, and products (Cont'd.)		I	R		✓
Identify critical in-process characteristics from specification(s) or drawing(s)		I	R		
Conduct in-process inspection		I	R		
Define appropriate inspection reports and follow-up		I	R		
Gauge R and R (reproducibility and repeatability)		I	R		
Use geometric tolerancing		I	R		
Competency: Demonstrate knowledge of nondestructive testing		I	R		
Competency Builders:					
Describe purpose of nondestructive testing		I	R		
Identify anomalies		I	R		
Define defects and discontinuities		I	R		
Identify factors contributing to defects and discontinuities		I	R		
Describe ultrasonic testing		I	R		
Describe advantages and limitations of ultrasonic testing		I	R		
Describe industrial radiography		I	R		
Describe use of wet and dry particles in magnetic particle inspection		I	R		
Explain advantages and limitations of penetrant inspection		I	R		
Describe microwave testing		I	R		
Describe holographic inspection		I	R		
Explain choice of most suitable nondestructive test method		I	R		

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Unit: Problem Solving	10	12	AD	LL	WS
Competency: Identify problem solving skills	R	C	R	✓	
Competency Builders:					
Explain problem solving procedures	R	C	R		
Explain logical support actions taken to problem solve	R	C	R		
Identify problem solving aids	R	C	R		
Competency: Use problem solving skills	I	R	R	✓	
Competency Builders:					
Differentiate normal and abnormal operations	I	R	R		
Follow problem solving procedures	I	R	R		
Take logical support actions	I	R	R		
Use problem solving aids	I	R	R		

Unit: Equipment Maintenance	10	12	AD	LL	WS
Competency: Perform housekeeping	I	C			
Competency Builders:					
Store hand tools, cutters, fixtures, jigs and attachments	I	C			
Store grinding wheels	I	C			
Report problems to supervisor	I	C			
Competency: Maintain hand tools	I	R	C		
Competency Builders:					
Demonstrate use and care of measuring devices (e.g., rules, tapes, calipers, micrometers, multimeter, thermometer, and coordinate measuring system)	I	R	C		
Demonstrate use and care of ropes, slings, pulleys, and block and tackle	I	C			
Demonstrate proper metal working bench skills (including use of vices, hacksaws, files, taps, dies, hand and bench grinders, and reamers)	I	R	C		
Competency: Maintain stationary equipment (operator level)	I	R	C		✓
Competency Builders:					
Demonstrate use and care of mechanical presses	I	R	C		
Demonstrate use and care of hydraulic presses	I	R	C		
Demonstrate use and care of drill presses	I	C			
Demonstrate use and care of bench grinders	I	R	C		
Demonstrate use and care of power saws (e.g., hack, cut-off, and band)	I	C			
Demonstrate use and care of lathes	I	R	C		
Demonstrate use and care of mills	I	R	C		
Demonstrate use and care of surface grinders	I	R	C		
Demonstrate use and care of miscellaneous metal working machines	I	R	C		

Unit: Basic Materials Science	10	12	AD	LL	WS
Competency: Demonstrate basic knowledge of metal forming	I	R	C		
Competency Builders:					
Define metal forming (e.g., general process)	I	R	C		
Identify forming industries (e.g., stamping, forging, fabricating)	I	R	C		
Describe metal forming principles	I	R	C		
Competency: Demonstrate basic knowledge of metallurgy		I	C		
Competency Builders:					
Define metallurgy	I	R	C		
Describe the metal forming process	I	R	C		
Describe metal forming principles	I	R	C		
Identify frequently used metals	I	R	C		
Describe the crystalline structures of metals		I	C		
Use periodic chart to evaluate metals		I	C		
List chemical properties of common metals		I	C		
List physical properties of common metals		I	C		
Describe measures of metal strength		I	C		
Identify examples of raw materials processed by hot rolling, cold rolling, forging, drawing, extrusion, spinning and powered metallurgy		I	C		
Competency: Demonstrate basic knowledge of heat treatment	I	R	C		
Competency Builders:					
Describe process of heat treating	I	R	C		
Define annealing	I	R	C		
Define drawing	I	R	C		
Define case hardening	I	R	C		
Define stress relieving	I	R	C		
Define tempering	I	R	C		

Unit: Basic Materials Science (Cont'd.)	10	12	AD	LL	WS
Competency: Demonstrate basic knowledge of heat treatment (Cont'd.)	I	R	C		
Define tempering	I	R	C		
Define critical temperature	I	R	C		
Perform heat treatment	I	R	C		
Competency: Demonstrate basic knowledge of mechanical properties testing		I	C		
Competency Builders:					
Explain tensile tests		I	C		
Perform tensile tests		I	C		
Explain hardness tests		I	C		
Perform hardness tests		I	C		
Explain impact tests		I	C		
Perform impact tests		I	C		
Competency: Demonstrate basic knowledge of metal characteristics and formability			C		✓
Competency Builders:					
Explain metal and formability basics		I	C		
Explain metal grades and coatings		I	C		
Explain part contour analysis		I	C		
Explain metal characteristics tests		I	C		
Explain tensile test		I	C		
Explain LDH test		I	C		
Explain bend test		I	C		
Explain hold expansion test		I	C		
Explain R-value test		I	C		
Explain hardness test	I	R	C		
Explain cup test		I	C		
Explain friction test		I	C		
Explain surface test	I	R	C		
Explain interpretation of metal characteristics tests		I	C		

Unit: Basic Materials Science (Cont'd.)	10	12	AD	LL	WS
Competency: Demonstrate basic knowledge of metal characteristics and formability (Cont'd.)			C		✓
Describe blank/die interactions (e.g., friction)			C		
Describe friction and forming process			C		
Describe circle grid basics		I	C		✓
Describe circle grid applications		I	C		✓
Describe formability diagnostics		I	C		✓
Describe documentation process		I	C		✓
Competency: Demonstrate basic knowledge of casting			C		
Competency Builders:					
Identify frequently used metals		I	C		
Describe crystalline structures of metals		I	C		
Use periodic chart in evaluating metals			C		
List chemical properties of common metals			C		
List physical properties of common metals			C		
Define permanent mold casting		I	C		
Define shell mold casting		I	C		
Define sand casting and pattern making		I	C		
Define die casting		I	C		
Identify basic casting terms		I	C		
Identify advantages/disadvantages of casting processes		I	C		
Define iron and its alloys	I	R	C		
Describe iron manufacturing process	I	R	C		
Describe the structure of iron and its alloys		I	C		
List chemical properties of iron and its alloys			C		

Unit: Basic Materials Science (Cont'd.)	10	12	AD	LL	WS
Competency: Demonstrate basic knowledge of iron and its alloys			C		
Competency Builders:					
List atomic structures of iron and its alloys			C		
List physical properties of iron and its alloys		I	C		
Describe iron and alloys property variables		I	C		
Describe measures of strength for iron and its alloys		I	C		
Identify examples of iron and its alloys processed by hot rolling, stamping, cold rolling, drawing, extrusion, spinning, casting, forging and machining		I	C		
Perform tensile test		I	C		
Perform hardness tests	I	R	C		
Competency: Demonstrate basic knowledge of aluminum and its alloys		I	C		
Competency Builders:					
Define aluminum and its alloys		I	C		
Describe aluminum manufacturing process		I	C		
Describe the structure of aluminum		I	C		
List chemical properties of aluminum		I	C		
List atomic structures of aluminum		I	C		
List physical properties of aluminum		I	C		
Describe aluminum property variables			C		
Identify examples of aluminum products processed by cold rolling, drawing, extrusion, stamping, spinning, casting, forging and machining		I	C		
Perform tensile tests		I	C		
Perform hardness tests		I	C		
Describe chemical analysis		I	C		

Unit: Basic Materials Science (Cont'd.)	10	12	AD	LL	WS
Competency: Demonstrate basic knowledge of copper and its alloys (e.g., brass, bronze)		I	C		
Competency Builders:					
Define copper and its alloys		I	C		
Describe copper manufacturing process		I	C		
Describe the structure of copper		I	C		
List chemical properties of copper		I	C		
List atomic structure of copper		I	C		
List physical properties of copper		I	C		
Describe copper property variables		I	C		
Describe measures of copper strength		I	C		
Identify examples of copper products processed by cold rolling, drawing, extrusion, stamping, spinning, casting, forging and machining		I	C		
Perform tensile tests		I	C		
Perform hardness tests		I	C		
Describe chemical analysis		I	C		
Competency: Demonstrate basic knowledge of plastics and polymers			C		
Competency Builders:					
Define plastics and polymers		I	C		
Describe plastics and polymers manufacturing processes		I	C		
Describe structure of plastics and polymers		I	C		
List chemical properties of plastics and polymers			C		
List physical properties of plastics and polymers			C		
Differentiate thermoset and thermoplastic			C		
Describe plastics and polymer property variables			C		
Describe measure of plastic and polymer strength			C		

Unit: Basic Materials Science (Cont'd.)	10	12	AD	LL	WS
Competency: Demonstrate basic knowledge of plastics and polymers (Cont'd.)			C		
Identify examples of raw materials processed by machining, extrusion, stamping, injection molding, compression molding and injection compression molding			C		
Perform tensile test			C		✓
Perform R-value test			C		✓
Identify molding defect (e.g., flash, sink marks, warp, contamination, wet material, stuck parts, short shot, burn marks, surface blemishes)			C		
Identify secondary operations performed on plastic parts			C		
Competency: Demonstrate basic knowledge of concrete			I	✓	✓
Competency Builders:					
Describe the formation of concrete			I		✓
List types of cements and their uses			I		✓
Define qualities on concrete (i.e., strength, consistency, homogeneity, tensile force, abrasion, heat of hydration, and heat and sulfate resistance)			I		✓
List tests used in concrete production (e.g., slump test, test of fineness modules)			I		✓
List protective practices used after pouring			I		✓
Competency: Demonstrate basic knowledge of ceramics		I	R		✓
Competency Builders:					
List ingredients of ceramic products		I	R		✓
List qualities of ceramic products		I	R		✓
Describe quality control tests (e.g., compressive strength test, wear resistance test, temperature resistance test)		I	R		✓
List use of ceramics		I	R		✓

Unit: Basic Materials Science (Cont'd.)	10	12	AD	LL	WS
Competency: Demonstrate knowledge of corrosion and protection		I	R		✓
Competency Builders:					
Identify causes of corrosion		I	R		✓
Identify types of corrosion		I	R		✓
List solutions to minimize problems		I	R		✓
Competency: Demonstrate basic knowledge of rubber manufacturing			C		
Competency Builders:					
Explain history of rubber industry	I	R	C		
Compare properties of natural rubber with those of synthetic rubber			C		
Explain how natural rubber is manufactured			C		
Explain vulcanization, mastication, and cure systems			C		
Explain use of compounding ingredients (e.g., carbon blacks, accelerators, fillers, antioxidants)			C		✓
Explain press and autoclave curing			C		
Explain how synthetic rubber is manufactured (e.g., neoprene, butyl, styrene-butadiene)			C		

Unit: Welding Basics	10	12	AD	LL	WS
Competency: Perform gas welding, brazing, and cutting			C		✓
Competency Builders:					
Follow safety guidelines			C		
Differentiate welding and brazing			C		
Identify gas welding and cutting equipment and accessories			C		
Use personal protective equipment required for welding and cutting			C		
Explain capillary attraction as it applies to metal			C		✓
Demonstrate proper lighting, adjusting, and shutting down of gas torch			C		
Layout mild steel			C		
Cut mild steel			C		
Braze mild steel		C			✓
Solder non-ferrous metals		I	C		✓
Apply basic metallurgy technology			C		
Competency: Perform arc welding/cutting			I		✓
Competency Builders:					
Identify arc welding equipment and accessories			C		
Explain process of resistance welding			C		
Explain process of projection welding			C		
Explain process of flash-butt welding	I	R	R		✓
Explain process of laser welding			R		✓
Explain process of friction welding			C		✓
Explain process of spot welding					✓
Explain process of shielded metal-arc welding (SMAW)		I	R		
Explain process of gas metal-arc welding (GMAW)		I	C		✓
Explain process of gas tungsten-arc welding		I	R		

Unit: Welding Basics (Cont'd.)	10	12	AD	LL	WS
Competency: Perform arc welding/cutting (Cont'd.)			I		✓
Explain process of plasma-arc cutting			I		
Explain process of carbon arc gouging and cutting			I		
Explain process of welding plastics		I	R		✓
Explain welding rod alloys			I		
Read welding rods			C		
Demonstrate use of mild steel welding rod			C		
Demonstrate use of low hydrogen welding electrode			C		
Explain rationale for preheating and post-heating metal			C		
Weld steel requiring preheat			C		
Weld cast iron			I		
Weld aluminum			I		
Apply basic metallurgy technology			I		✓
Demonstrate (GMAW) welding in flat, horizontal, vertical positions			I		
Demonstrate (GTAW) welding on mild steel, stainless steel, and aluminum			I		✓
Demonstrate process of build up and hard facing			C		
Troubleshoot fusion of materials			C		

Unit: Precision Machining	10	12	AD	LL	WS
Competency: Perform prerequisite machining skills			C		
Competency Builders:					
Demonstrate proficiency in maintaining immediate work area, machinery, and tools	I	C			
Demonstrate proficiency in reading blueprints/drawings	I	R	C		
Demonstrate proficiency in planning work sequence	I	R	C		
Follow safety rules and regulations		C			
Competency: Analyze machine shop jobs	I	R	C		
Competency Builders:					
Identify sequence of work on specified project(s)	I	R	C		
Identify tolerances and finishes on specified project(s)	I	C			
Identify variables that effect job efficiency	R	C			
Explain use of the Machinery Handbook	I	R	C		
Use Machinery Handbook	I	R	C		
Competency: Perform bench operations	I	R	C		
Competency Builders:					
Use measuring instruments and hand tools	I	C			
Deburr workpiece	I	C			
Lay out workpiece	I	R	C		
Drill hole	I	C			
Hand tap hole	I	C			
Cut threads with die	I	C			
Apply basic metallurgy technology	I	R	C		
Competency: Operate metal cutting saw (i.e., cut-off, abrasive, and contour saw)	I	C			
Competency Builders:					
Transfer dimensions from blueprint	I	C			

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Unit: Precision Machining (Cont'd.)	10	12	AD	LL	WS
Competency: Operate metal cutting saw (i.e., cut-off, abrasive, and contour saw) (Cont'd.)	I	C			
Clean metal cutting saw	I	C			
Lubricate metal cutting saw	I	C			
Install guides	I	C			
Adjust guides	I	C			
Weld saw blade	I	C			
Install saw blade	I	C			
Select speeds and feeds	I	C			
Cut metal	I	C			
Deburr workpiece	I	C			
Apply basic metallurgy technology	I	C			
Describe use of coolants for metal cutting saws	I	C			
Describe use of abrasive saws	I	C			
Competency: Operate drill press	I	C			✓
Competency Builders:					
Clean drill press	I	C			
Lubricate drill press	I	C			
Mount part	I	C			
Select proper bit and speed	I	C			
Drill part	I	C			
Countersink	I	C			
Tap hole	I	C			
Apply basic metallurgy technology	I	C			
Competency: Operate tool and cutter grinding machine		I	R		✓
Competency Builders:					
Identify parts of machine	I	R	C		
Select proper wheels and work holding devices (e.g., superabrasives)		I	R		✓
Perform truing operations	I	C			
Perform dressing operations	I	C			

Unit: Precision Machining (Cont'd.)	10	12	AD	LL	WS
Competency: Operate tool and cutter grinding machine (Cont'd.)		I	R		✓
Perform forming operations		I	R		✓
Select proper speeds					
Sharpen end mill	I	R	C		
Sharpen horizontal milling cutter	I	R	C		
Sharpen drills and countersinks	I	R	C		
Apply basic metallurgy technology	I	R	C		
Competency: Operate pedestal or bench grinder	I	R	C		✓
Competency Builders:					
Clean pedestal or bench grinder	I	C			
Lubricate pedestal or bench grinder	I	R	C		
Check wheel for defects	I	R	C		
Mount wheel	I	C			
Position guard and rest	I	C			
Dress wheel	I	C			
Sharpen drill bit	I	R	C		
Apply basic metallurgy technology	I	R	C		
Competency: Operate lathe	I	R	C		✓
Competency Builders:					
Clean and lubricate lathe	I	C			
Sharpen tools	I	R	C		
Mount workpiece	I	R	C		
Use dial indicator	I	R	C		
Position guards	I	C			
Select feed(s) and speed(s)	I	R	C		
Face workpiece	I	R	C		
Turn shaft	I	R	C		
Turn taper	I	R	C		
Knurl workpiece	I	R	C		
Cut off workpiece	I	R	C		

Unit: Precision Machining (Cont'd.)	10	12	AD	LL	WS
Competency: Operate lathe (Cont'd.)	I	R	C		✓
Center drill hole	I	C			
Cut threads (e.g., ID, OD, metric, English)	I	R	C		
Turn inside bore	I	R	C		
Apply basic metallurgy technology	I	R	C		
Describe different types of threads	I	R	C		
Describe proper use of coolants	I	R	C		
Use taper attachments	I	R	C		
Competency: Operate milling machine	I	R	C		✓
Competency Builders:					
Clean milling machine	I	C			
Lubricate milling machine	I	C			
Mount workpiece	I	R	C		
Mount tool	I	R	C		
Mill surface	I	R	C		
Mill keyway	I	R	C		
Drill workpiece	I	R	C		
Bore with milling machine	I	R	C		
Mill angle	I	R	C		
Apply basic metallurgy	I	R	C		
Tram head to table	I	R	C		
Use sineplate or sine bar	I	R	C		
Select feeds and speeds	I	R	C		
Describe use and application of climb milling vs. conventional milling	I	R	C		
Describe use of rotary table	I	R	C		
Describe use of index head	I	R	C		
Describe different types of milling machines	I	R	C		
Describe proper use of coolants	I	R	C		

Unit: Precision Machining (Cont'd.)	10	12	AD	LL	WS
Competency: Operate surface grinder	I	R	C		✓
Competency Builders:					
Clean surface grinder	I	C			
Lubricate surface grinder	I	C			
Check wheel for defects	I	C			
Mount wheel	I	C			
Position guard	I	C			
Dress wheel	I	C			
Mount workpiece	I	C			
Set surface grinder	I	C			
Apply basic metallurgy technology	I	R	C		
Describe proper use of coolants	I	C			
Describe sine plates and the standards	I	R	C		
Use sine tables	I	R	C		
Use sine plates (standard and compound)	I	R	C		
Use permanent and electromagnetic chucks (safety issue)	I	C			
Competency: Select materials		I	R		
Competency Builders:					
Interpret color codes, numbering systems, and classification systems of materials (i.e., ANSI, SAE)		I	R		
Select material for job		I	R		✓
Identify metals using spark test		I	R		✓
Identify metals using variety of tests		I	R		
Identify materials		I	R		
Competency: Perform heat treatment of metals		I	R		✓
Competency Builders:					
Test hardness of metals		I	R		
Perform non-destructive testing		I	R		✓
Perform destructive testing		I	R		

Unit: Precision Machining (Cont'd.)	10	12	AD	LL	WS
Competency: Perform heat treatment of metals (Cont'd.)		I	R		✓
Harden metals to job specifications		I	R		
Temper metals to job specifications		I	R		
Anneal metals to job specifications		I	R		
Normalize metals to job specifications		I	R		
Case harden metals to job specifications		I	R		
Competency: Demonstrate basic knowledge of nontraditional machining processes			I		
Competency Builders:					
Describe principles of chemical etching			I		
List applications of chemical etching			I		
List advantages/disadvantages of chemical etching			I		
Describe principles of photochemical etching			I		
List applications of photochemical etching			I		
List advantages/disadvantages of photochemical etching			I		
Describe electrical-discharge machining (EDM)		I	R		
List applications of EDM		I	R		
Differentiate between EDM and wire EDM		I	R		
List applications for wire EDM		I	R		
Describe principles of electrochemical machining			I		
List applications of electrochemical machining			I		
List advantages/disadvantages of electrochemical machining			I		✓
Describe principles of water jet cutting			I		✓

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Unit: Precision Machining (Cont'd.)	10	12	AD	LL	WS
Competency: Demonstrate basic knowledge of nontraditional machining processes (Cont'd.)			I		✓
Describe principles of torch cutting		I	R		✓
List applications of torch cutting		I	R		✓
Describe principles of laser cutting			I		✓
List applications of laser cutting			I		✓
List advantages/disadvantages of laser cutting			I		✓
Competency: Inspect part		I	C		✓
Competency Builders:					
Identify appropriate tools for measuring	I	R	C		
Define precision, accuracy, tolerance, reliability, and discrimination	I	R	C		
Define standard stock dimensions and tolerances	I	R	C		
Describe common measurements errors and correction procedures	I	R	C		
Calibrate measuring devices	I	R	C		
Demonstrate care of measuring instruments	I	C			
Demonstrate use of rule	I	C			
Demonstrate use of tape	I	C			
Demonstrate use of combination square	I	R	C		
Demonstrate use of calipers	I	R	C		
Demonstrate use of micrometers	I	R	C		
Demonstrate use of dial indicators	I	R	C		
Demonstrate use of sine bar		I	C		
Demonstrate use of gauges (specifically dial-bore)	I	R	C		
Demonstrate use of surface plate	I	R	C		
Demonstrate use of protractor	I	R	C		
Demonstrate use of profilometer	I	R	C		
Demonstrate use of thermometer		I	C		

Unit: Precision Machining (Cont'd.)	10	12	AD	LL	WS
Competency: Inspect part (Cont'd.)		I	C		
Demonstrate use of dividers	I	R	C		
Demonstrate use of gauge blocks	I	R	C		
Demonstrate use of optical comparitor		I	C		
Demonstrate use of thread gauges, wires, and mikes	I	R	C		
Demonstrate use of digital instruments		I	C		
Describe advantage of electronic gauging equipment		I	C		
Describe operation of coordinate measuring machine		I	C		

Unit: Computerized Numerical Control (CNC)	**10**	**12**	**AD**	**LL**	**WS**
Competency: Demonstrate knowledge of CNC	I	R	C		✓
Competency Builders:					
Define NC, CNC, and DNC	I	R	C		
Explain differences of NC and CNC	I	R	C		
Describe closed loop, open loop, and adaptive controls	I	R	C		
Define point to point systems	I	R	C		
Identify tool movement of point to point systems	I	R	C		
Define continuous path systems	I	R	C		
Identify tool movements of continuous path systems	I	R	C		
Identify data input mediums	I	R	C		
Explain the purpose of the post-processor	I	R	C		
Define canned cycles	I	R	C		
List advantages/disadvantages of CNC machining centers	I	R	C		
Explain distributed numerical control (DNC)	I	R	C		
Competency: Apply CNC operations	I	R	C		✓
Competency Builders:					
Identify parts of the machine	I	C			
Apply basic programming skills to a turning and/or a milling operation	I	R	C		
Select proper work holders	I	R	C		
Select proper cutting tools	I	R	C		
Set machine parts to drawing tolerances	I	R	C		
Demonstrate use of CADD/CAM for simple part program development	I	R	C		
Competency: Prepare program		I	R	✓	
Competency Builders:					
Write a program manually in word address format		I	C		
Write a program off line		I	C		

Unit: Computerized Numerical Control (CNC) (Cont'd.)	10	12	AD	LL	WS
Competency: Prepare program (Cont'd.)		I	R	✓	
Write a program manually in conversational program		I	R		✓
Generate a program using CADD/CAM package		I	R		
Program machine using manual data input (MDI) process		I	C		
Competency: Program CNC operations	▨	▨	C	✓	
Competency Builders:					
Apply ANSI drawing standards		I	C		
Perform process planning from drawing to finished product		I	C		
Analyze workpiece for CNC		I	C		
Perform basic trigonometric computations	I	R	C		
Establish chip load, feed rates and surface feet per minute limitations		I	C		
Apply Met-Cut standards			C		
Turn intersection points into segments (i.e., defined in terms of points, lines, and circles)			C		
Edit program	I	R	C		
Competency: Load machine		I	C	✓	
Competency Builders:					
Load program from MDI and off-line programming station		I	C		
Prepare work-holding devices	I	R	C		
Mount work-holding device	I	R	C		
Secure workpiece	I	R	C		
Set up reference and clearance points	I	R	C		
Set up tooling	I	R	C		
Competency: Operate CNC machine	I	R	C	✓	
Competency Builders:					
Load raw material	I	R	C		
Start cycle	I	R	C		

Unit: Computerized Numerical Control (CNC) (Cont'd.)	10	12	AD	LL	WS
Competency: Operate CNC machine (Cont'd.)	I	R	C	✓	
Monitor work in-process	I	R	C		
Edit CNC programs	I	R	C		
Competency: Perform preventive maintenance	▨	▨	C	▨	✓
Competency Builders:					
Follow proper safety procedures	I	C			
Clean CNC equipment	I	C			
Lubricate CNC equipment	I	R	C		
Check CNC equipment for wear and alignment			C		

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Unit: Drafting Technology	10	12	AD	LL	WS
Competency: Apply basic drafting skills		I	C	✓	
Competency Builders:					
Use drafting equipment, measuring scales, drawing media, drafting instruments and consumable materials	I	C			
Identify line styles, weights (alphabet of lines)	I	C			
Select proper drawing scale	I	C			
Prepare title blocks and other drafting formats	I	C			
Apply various freehand and other lettering techniques	I	C			
Prepare multi-view drawings	I	C			
Prepare multi-view sketches	I	C			
Prepare orthographic views	I	C			
Prepare change control block/revision block	I	C			
Describe change control purpose and procedure	I	C			
Measure angles	I	C			
Draw horizontal, vertical, angular, parallel, and perpendicular lines	I	C			
Transfer an angle	I	C			
Construct tangent lines (to arcs) and tangent arcs (to arcs)	I	C			
Bisect angles and arcs	I	C			
Bisect lines	I	C			
Divide lines	I	C			
Construct three-point circle	I	C			
Construct regular hexagon, pentagon, and octagon	I	C			
Reproduce a drawing	I	C			
Prepare single-view drawings	I	C			
Prepare dimension drawings		I	C		
Interpret notes and dimensions to determine part		I	C		

Unit: Drafting Technology (Cont'd.)	10	12	AD	LL	WS
Competency: Apply basic drafting skills (Cont'd.)		I	C	✓	
Draw arcs and circles		I	C		
Transfer measurements		I	C		
Competency: Apply intermediate drafting skills		I	C	✓	
Competency Builders:					
Describe types of blueprints and their applications	I	R	C		
Apply isometric, oblique and perspective sketching techniques		I	C		
Prepare isometric, oblique and perspective sketches		I	C		
Prepare sectional views		I	C		
Prepare auxiliary views		I	C		
Identify ANSI symbols	I	R	C		
Prepare views of drilled and tapped holes, counterbores, countersinks	I	R	C		
Identify a bill of materials	I	R	C		
Dimension drawings using ANSI$_{y}$14.5 standard		I	C		
Describe purpose of auxiliary and sectional views	I	R	C		
Competency: Read basic blueprints	I	R	C		
Competency Builders:					
Visualize object from drawing	I	R	C		
Interpret orthographic projections	I	R	C		
Interpret isometric views	I	R	C		
Interpret sectional views	I	R	C		
Interpret dimensions	I	R	C		
Competency: Read intermediate-level blueprints	I	R	C	✓	
Competency Builders:					
Interpret detail and assembly drawings	I	R	C		
Interpret tolerances	I	R	C		

Unit: Drafting Technology (Cont'd.)	10	12	AD	LL	WS
Competency: Read intermediate-level blueprints (Cont'd.)	I	R	C	✓	
Interpret screw thread specifications	I	R	C		
Competency: Demonstrate knowledge of basic tolerancing		I	C	✓	
Competency Builders:					
Identify geometric characteristics and symbols (i.e., flatness, straightness, roundness, cylindricity, profile of line, profile of surface, perpendicularly, angularity, parallelism, circular, runout, total, indicated runout, position, concentricity, and symmetry)		I	C		
Define maximum material condition		I	C		
Define least material condition		I	C		
Define regardless of feature size condition		I	C		
Describe feature control blocks		I	C		
Describe datum surfaces and targets		I	C		
Define flatness (pitch)		I	C		
Define straightness (yaw)		I	C		
Define roundness		I	C		
Define cylindrically		I	C		
Define profile of line		I	C		
Define profile of surface		I	C		
Define perpendicularity		I	C		
Define angularity		I	C		
Define parallelism		I	C		
Define circular runout		I	C		
Define total runout		I	C		
Apply true position concept to determine tolerance for location of holes in mating parts		I	C		
Dimension fits, tolerances, and symbols		I	C		

Unit: Drafting Technology (Cont'd.)	10	12	AD	LL	WS
Competency: Convert dimensions and tolerances	C	▨	▨	▨	▨
Competency Builders:					
Convert dimensions and tolerances from English units to metric units	C				
Convert dimensions and tolerances from metric units to English units	C				
Competency: Demonstrate basic dimensioning techniques	▨	▨	C	▨	▨
Competency Builders:					
Construct arrowheads			C		
Dimension arcs			C		
Dimension angles			C		
Dimension rounded-end shapes			C		
Dimension spherical objects			C		
Dimension cylindrical objects			C		
Add notes to drawing			C		

Unit: Basic Diemaking	10	12	AD	LL	WS
Competency: Describe the theory of cutting	▨	▨	I	✓	✓
Competency Builders:					
Describe the features of a cut			I	✓	✓
Describe metal grain deformation			I	✓	✓
Explain the efforts of clearance variation			I	✓	✓
Calculate the percentage of penetration			I	✓	✓
List the courses of metal burring			I	✓	✓
Explain the causes of part distortion			I	✓	✓
Define the term web			I	✓	✓
List an advantage and disadvantage of secondary shear			I	✓	✓
Describe the causes of three areas of punch/die wear			I	✓	✓
Competency: Define cutting forces	▨	▨	I	✓	✓
Competency Builders:					
Define force			I	✓	✓
Define pressure			I	✓	✓
Define area			I	✓	✓
Define shear strength			I	✓	✓
Define tensile strength			I	✓	✓
Define shear			I	✓	✓
Perform calculations to determine the maximum cutting forces required for a specific part when given the material specifications			I	✓	✓
Calculate the proper shear angle for a specific material			I	✓	✓
Calculate stripping force for a specific punch and material			I	✓	✓
Competency: Describe cutting operations	▨	▨	I	✓	✓
Competency Builders:					
Describe shearing and when it should be performed			I	✓	✓

Unit: Basic Diemaking (Cont'd.)	10	12	AD	LL	WS
Competency: Describe cutting operations (Cont'd.)	▨	▨	I	✓	✓
Describe cutoff and when it should be performed			I	✓	✓
Describe parting and when it should be performed			I	✓	✓
Describe blanking and when it should be performed			I	✓	✓
Describe punching and when it should be performed			I	✓	✓
Describe slotting and when it should be performed			I	✓	✓
Describe perforating and when it should be performed			I	✓	✓
Describe notching and when it should be performed			I	✓	✓
Describe seminotching and when it should be performed			I	✓	✓
Describe lancing and when it should be performed			I	✓	✓
Describe trimming and when it should be performed			I	✓	✓
Describe slitting and when it should be performed			I	✓	✓
Describe shaving and when it should be performed			I	✓	✓
Competency: Define metal bending	▨	▨	I	✓	✓
Competency Builders:					
Define metal bending			I	✓	✓
List the internal metal movement in the area of a bend			I	✓	✓
Describe the internal metal movement in the area of a bend			I	✓	✓
Describe the forces occurring during a bend			I	✓	✓
Calculate blank length necessary to obtain proper part dimensions after bending			I	✓	✓
Define springback			I	✓	✓
List three methods for correcting springback			I	✓	✓

Unit: Basic Diemaking (Cont'd.)	10	12	AD	LL	WS
Competency: Define metal bending (Cont'd.)	▨	▨	I	✓	✓
Describe three methods for correcting springback			I	✓	✓
Calculate forces required for bending			I	✓	✓
Describe recoil			I	✓	✓
Describe corrective actions for recoil			I	✓	✓
Describe six bending terms as per operation and shape			I	✓	✓
Competency: Define metal forming	▨	▨	I	✓	✓
Competency Builders:					
List four embossing operations			I	✓	✓
Describe four embossing operations			I	✓	✓
Describe the primary purpose of beads			I	✓	✓
Describe the primary purpose of ribs			I	✓	✓
Describe the primary purpose of decorative embossing			I	✓	✓
List four functions performed by offsets			I	✓	✓
Calculate forces necessary for embossing a specified metal and thickness			I	✓	✓
Describe the two types of embossing dies			I	✓	✓
Describe metal flow during the embossing operations			I	✓	✓
Calculate embossing depth			I	✓	✓
List tube forming operations			I	✓	✓
Describe tube forming operations			I	✓	✓
Competency: Define cup drawing	▨	▨	I	✓	✓
Competency Builders:					
Describe drawing			I	✓	✓
Describe redrawing			I	✓	✓
Describe shallow draw			I	✓	✓
Describe deep draw			I	✓	✓

Unit: Basic Diemaking (Cont'd.)	10	12	AD	LL	WS
Competency: Define cup drawing (Cont'd.)	▨	▨	I	✓	✓
Describe draw radius			I	✓	✓
Describe draw bevel			I	✓	✓
Describe drawn off			I	✓	✓
Explain the action/cause of friction			I	✓	✓
Explain the action/cause of bending			I	✓	✓
Explain the action/cause of straightening			I	✓	✓
Explain the action/cause of compression			I	✓	✓
Explain the action/cause of tension			I	✓	✓
Describe the stretch drawing process			I	✓	✓
Determine the larger radius, punch or die			I	✓	✓
Determine die radius limits when given material thickness			I	✓	✓
List the benefits of using a blankholder			I	✓	✓
List three variables of friction			I	✓	✓
Describe three variable of friction			I	✓	✓
Describe two purposes served by lubricants			I	✓	✓
Determine the most likely cause of orange peel			I	✓	✓
Determine the most likely cause of earing			I	✓	✓
Determine the most likely cause of scratching			I	✓	✓
Determine the most likely cause of stretcher			I	✓	✓
Determine the most likely cause of strains			I	✓	✓
Determine the most likely cause of springback			I	✓	✓

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Unit: Basic Diemaking (Cont'd.)	10	12	AD	LL	WS
Competency: Describe planning cupping operations			I	✓	✓
Competency Builders:					
Describe four causes of non-uniform draws			I	✓	✓
Compute the blank diameter including trim allowance for a given cup			I	✓	✓
Calculate the punch diameter when given blank when given blank diameter and the percentage of reduction			I	✓	✓
Describe when to perform trimming in the drawing process			I	✓	✓
Describe the procedure used in trimming			I	✓	✓
Describe when to perform holepunching in the drawing process			I	✓	✓
Describe the procedure used in holepunching			I	✓	✓
Describe when to perform embossing in the drawing process			I	✓	✓
Describe the procedure used in embossing			I	✓	✓
Describe when to perform restrike in the drawing process			I	✓	✓
Describe the procedure used to restrike			I	✓	✓
Describe when to perform bulging in the drawing process			I	✓	✓
Describe the procedure used in bulging			I	✓	✓
Competency: Describe box drawing			I	✓	✓
Competency Builders:					
Describe the metal flow occurring during a box drawing operation			I	✓	✓
Describe the difference of direction in the flow rate wrinkles in the corners and wall sections			I	✓	✓
List the causes of loose metal			I	✓	✓
Describe the means utilized to prevent loose metal			I	✓	✓

Unit: Basic Diemaking (Cont'd.)	10	12	AD	LL	WS
Competency: Describe box drawing (Cont'd.)			I	✓	✓
Describe the difference between a draw and a bend and straighten operation			I	✓	✓
Describe the stretch forming process			I	✓	✓
Competency: Describe miscellaneous operations			I	✓	✓
Competency Builders:					
Describe slugging			I	✓	✓
Describe restrike			I	✓	✓
Describe spank			I	✓	✓
Describe extrusion			I	✓	✓
Describe pierce			I	✓	✓
Describe coining			I	✓	✓
Describe press forging			I	✓	✓
Describe Smith forging			I	✓	✓
Describe hot trimming			I	✓	✓
Describe cold trimming			I	✓	✓
Describe burnishing			I	✓	✓
Describe ironing			I	✓	✓
Describe stamping			I	✓	✓
Competency: Define die types and construction			I	✓	✓
Competency Builders:					
Describe cutoff die and its operation			I	✓	✓
Describe drop through die and its operation			I	✓	✓
Describe return type die and its operation			I	✓	✓
Describe compound die and its operation			I	✓	✓
Describe combination die and its operation			I	✓	✓
Describe continental die and its operation			I	✓	✓

Unit: Basic Diemaking (Cont'd.)	10	12	AD	LL	WS
Competency: Define die types and construction (Cont'd.)			I	✓	✓
Describe subpress die and its operation			I	✓	✓
Describe progressive die and its operation			I	✓	✓
Describe transfer die and its operation			I	✓	✓
Describe shuttle die and its operation			I	✓	✓
Competency: Define press classification and selection			I	✓	✓
Competency Builders:			I	✓	✓
Identify the major components of a press			I	✓	✓
Describe the identifying characteristics of an inclinable press			I	✓	✓
Describe the identifying characteristics of a solid frame press			I	✓	✓
Describe the identifying characteristics of a knee frame press			I	✓	✓
Describe the identifying characteristics of a horning press			I	✓	✓
Describe the identifying characteristics of an open end press			I	✓	✓
Describe the identifying characteristics of a solid press			I	✓	✓
Describe the identifying characteristics of a tie rod press			I	✓	✓
Describe the identifying characteristics of a pillar press			I	✓	✓
Explain the design purpose for an inclinable press			I	✓	✓
Explain the design purpose for a solid frame press			I	✓	✓
Explain the design purpose for a knee frame press			I	✓	✓
Explain the design purpose for a horning press			I	✓	✓

Unit: Basic Diemaking (Cont'd.)	10	12	AD	LL	WS
Competency: Define press classification and selection (Cont'd.)	▨	▨	I	✓	✓
Explain the design purpose for an open end press			I	✓	✓
Explain the design purpose for a solid press			I	✓	✓
Explain the design purpose for a tie rod press			I	✓	✓
Explain the design purpose for a pillar press			I	✓	✓
Describe press classification by inclinable position			I	✓	✓
Describe press classification by horizontal position			I	✓	✓
Describe the action of a single action press			I	✓	✓
Describe the action of a double action press			I	✓	✓
Describe the action of a triple action press			I	✓	✓
Explain the positive or negative benefits of a crankshaft			I	✓	✓
Explain the positive or negative benefits of an eccentric shaft			I	✓	✓
Explain the positive or negative benefits of an eccentric gear			I	✓	✓
Explain the positive or negative benefits of a cam			I	✓	✓
Explain the positive or negative benefits of a knuckle			I	✓	✓
Explain the positive or negative benefits of a hydraulic			I	✓	✓
Explain the positive or negative benefits of a single drive			I	✓	✓
Explain the positive or negative benefits of a twin drive			I	✓	✓
Explain the positive or negative benefits of a quadruple drive			I	✓	✓
Explain the positive or negative benefits of a direct drive			I	✓	✓

Unit: Basic Diemaking (Cont'd.)	10	12	AD	LL	WS
Competency: Define press classification and selection (Cont'd.)	▨	▨	I	✓	✓
Describe the benefits of an underdrive press			I	✓	✓
Explain the benefits of multiple point suspension			I	✓	✓
Calculate energy requirements necessary for the operation of a die			I	✓	✓
Calculate press tonnage available at a specified crank position			I	✓	✓
Explain how press tonnage relates to bearing size			I	✓	✓
Describe press speed relative to stroke length			I	✓	✓
Determine the punch speed for a specified stroke length when given the number of strokes per minute			I	✓	✓
Define the term "shut height"			I	✓	✓
Describe the function of press gibing			I	✓	✓
Competency: Describe automatic feeds	▨	▨	I	✓	✓
Competency Builders:					
Describe the operation of powered reels and cradles			I	✓	✓
Describe the operation of idle reels and cradles			I	✓	✓
Describe the operation of direct linkage roll feeds			I	✓	✓
Describe the operation of cam roll feeds			I	✓	✓
Describe the operation of independent power roll feeds			I	✓	✓
Describe the operation of plain roller feeds			I	✓	✓
Describe the operation of one-way roller feeds			I	✓	✓
Describe the operation of push-pull roll feeds			I	✓	✓
Describe the operation of hitch feeds			I	✓	✓

Unit: Basic Diemaking (Cont'd.)	10	12	AD	LL	WS
Competency: Describe automatic feeds (Cont'd.)			I	✓	✓
Describe the operation of vibration hopper feeds			I	✓	✓
Describe the operation of rotating hopper feeds			I	✓	✓
Describe the operation of direct dial feeds			I	✓	✓
Describe the operation of indirect dial feeds			I	✓	✓
Describe the operation of chutes			I	✓	✓
Describe the operation of slides			I	✓	✓
Describe the operation of magazine feeds			I	✓	✓
Describe the operation of step feeds			I	✓	✓
Describe the operation of tilt table feeds			I	✓	✓
Describe the operation of draw bridge feeds			I	✓	✓
Describe the operation of roller table feeds			I	✓	✓
Describe the operation of pusher feeds			I	✓	✓
Describe the operation of a drop-through gravity ejection mechanism			I	✓	✓
Describe the operation of an inclined press gravity ejection mechanism			I	✓	✓
Describe the operation of a chute gravity ejection mechanism			I	✓	✓
Describe the operation of an air ejection mechanism			I	✓	✓
Describe the operation of a kicker ejection mechanism			I	✓	✓
Describe the operation of a lifter ejection mechanism			I	✓	✓
Describe the operation of a shovel ejection mechanism			I	✓	✓
Describe the operation of a mechanical hand ejection mechanism			I	✓	✓

Unit: Basic Diemaking (Cont'd.)	10	12	AD	LL	WS
Competency: Describe automatic feeds (Cont'd.)			I	✓	✓
Describe the operation of an ejection by next part			I	✓	✓
Explain the operation and use of a conveyor transfer mechanism			I	✓	✓
Describe the operation and use of a shuttle transfer mechanism			I	✓	✓
Describe the operation and use of a turnover transfer mechanism			I	✓	✓
Describe the operation and use of a turnaround transfer mechanism			I	✓	✓
Describe the operation and use of a stacker transfer mechanism			I	✓	✓
Describe the operation and use of a rails transfer mechanism			I	✓	✓
Competency: Describe die components			I	✓	✓
Competency Builders:					
Define the term "die set"			I	✓	✓
List 6 of 8 functions for a die set			I	✓	✓
Describe the function of the guide pins			I	✓	✓
Define the application of the die steel and punch steel components			I	✓	✓
Select a die spring for a described function			I	✓	✓
Describe the function of a moveable stripper plate			I	✓	✓
Describe the function of a solid stripper plate			I	✓	✓
Describe the function of a knockout plate			I	✓	✓
Describe the function of a hold down plate			I	✓	✓
Describe the function of a pad plate			I	✓	✓
Describe the function of a blank holder			I	✓	✓

Unit: Basic Diemaking (Cont'd.)	10	12	AD	LL	WS
Competency: Describe die components (Cont'd.)	▨	▨	I	✓	✓
Describe three methods used to provide the force required to activate a moveable stripper plate, solid stripper plate, knockout plate, hold down plate, pad plate, and a blank holder			I	✓	✓
Describe the assembly of a die including the proper location of the fasteners			I	✓	✓
Describe the function of a heel			I	✓	✓
Describe the function of a stop block			I	✓	✓
Describe the function of a bolster plate			I	✓	✓
Describe the function of a backing plate			I	✓	✓
Describe the function of a pilot			I	✓	✓
Describe the function of a gage			I	✓	✓
Describe the function of cams, hinges, and rockers			I	✓	✓
Demonstrate the use of a catalogue for the purpose of ordering commercially available die components and accessories for a specified die assembly			I	✓	✓
Competency: Describe die design	▨	▨	I	✓	✓
Competency Builders:					
Describe the proper design of solid cutting dies			I	✓	✓
Describe the proper design of sectional cutting dies			I	✓	✓
Describe the proper design of pedestal punches			I	✓	✓
Describe the proper design of plain punches			I	✓	✓
Describe the proper design of flanged punches			I	✓	✓
Describe the proper design of punch plate mounted punches			I	✓	✓

Unit: Basic Diemaking (Cont'd.)	10	12	AD	LL	WS
Competency: Describe die design (Cont'd.)	▨	▨	I	✓	✓
Describe the proper design of moveable stripper			I	✓	✓
Describe the proper design of solid strippers			I	✓	✓
Describe the proper design of keepers			I	✓	✓
Describe the proper design of knockouts			I	✓	✓
Describe the proper design of stop blocks			I	✓	✓
Describe the proper design of gages			I	✓	✓
Describe the proper design of chutes			I	✓	✓
Select the proper material and/or vendor items to complete construction of a die			I	✓	✓
Determine proper shut height for a die set			I	✓	✓
Explain function of a bolster plate			I	✓	✓
Competency: Explain die component analysis	▨	▨	I	✓	✓
Competency Builders:					
Perform the mathematical analysis for applicable clearance, stresses, friction, deflection, and static load for punches			I	✓	✓
Perform the mathematical analysis for applicable clearance, stresses, friction, deflection, and static load for dies			I	✓	✓
Perform the mathematical analysis for applicable clearance, stresses, friction, deflection, and static load for guide pins			I	✓	✓
Perform the mathematical analysis for applicable clearance, stresses, friction, deflection, and static load for heels			I	✓	✓
Perform the mathematical analysis for applicable clearance, stresses, friction, deflection, and static load for die pins			I	✓	✓

Unit: Basic Diemaking (Cont'd.)	**10**	**12**	**AD**	**LL**	**WS**
Competency: Explain die component analysis (Cont'd.)			I	✓	✓
Perform the mathematical analysis for applicable clearance, stresses, friction, deflection, and static load for shoes			I	✓	✓
Perform the mathematical analysis for applicable clearance, stresses, friction, deflection, and static load for pressure plate systems			I	✓	✓
Describe methods utilized to counteract the side thrust and the undesirable forces exerted on punches, dies, guide pins, heels, die pins, shoes, and pressure plate systems			I	✓	✓
Describe causes of mounting and other breakage of die components			I	✓	✓
Describe screw placement to prevent die component tipping			I	✓	✓
Describe the function of 5 pressure plates commonly used in dies			I	✓	✓
Select screws when given stress load and torque requirements			I	✓	✓
Describe the cause of screw breakage due to torque			I	✓	✓
Describe die mounting procedure to counteract side thrust due to poorly maintained press			I	✓	✓
Describe thrust directions derived from cams			I	✓	✓
Competency: Describe stock layout			I	✓	✓
Competency Builders:					
Determine the scrap percentage for a specified stock layout			I	✓	✓
Explain the layout of a stock strip for a specified part and stock strip width			I	✓	✓
Determine the required part spacing for designated material thickness			I	✓	✓
Calculate the punch clearance for cutting and forming operations			I	✓	✓

Unit: Basic Diemaking (Cont'd.)	10	12	AD	LL	WS
Competency: Describe stock layout (Cont'd.)			I	✓	✓
Describe bend strength relative to fiber direction			I	✓	✓
Determine stock layout for double pass die operation			I	✓	✓
Describe die component placement relative to balance of ram force			I	✓	✓
Determine if press capacity is compatible with force required to cut blanks			I	✓	✓
Determine the required strip layout and select the stock type when given the number of parts and material thickness			I	✓	✓
Relate die cost to stock layout			I	✓	✓
Competency: Define drafting			I	✓	✓
Competency Builders:			I	✓	✓
Describe the contents and/or purpose of a plan view of a die			I	✓	✓
Describe the contents and/or purpose of a plan view of a punch			I	✓	✓
Describe the contents and/or purpose of a cross-sectional view from right to left of a die drawing			I	✓	✓
Describe the contents and/or purpose of a cross-sectional view from front to back of a die drawing			I	✓	✓
Describe the contents and/or purpose of a partial cross-section view of a die drawing			I	✓	✓
Describe the contents and/or purpose of a side and front view of a die drawing			I	✓	✓
Describe the contents and/or purpose of a view of a die drawing in direction of arrow			I	✓	✓
Describe the contents and/or purpose of an enlarged view of a die drawing			I	✓	✓
Describe five methods utilized in showing the plan views of a punch and die			I	✓	✓

Unit: Basic Diemaking (Cont'd.)	10	12	AD	LL	WS
Competency: Define drafting (Cont'd.)	▨	▨	I	✓	✓
Determine which details of a die that are commonly cross hatched on cross-sectional views			I	✓	✓
Explain how to apply the eight guides to correct die dimensioning			I	✓	✓
Explain how to correctly number detail balloons and apply notes			I	✓	✓
Interpret the information obtained in a title block			I	✓	✓
Competency: Describe sheet metal processing	▨	▨	I	✓	✓
Competency Builders:					
Identify critical dimensions, critical surfaces, and baseline from part print			I	✓	✓
Describe geometric control and mechanical control of a part			I	✓	✓
Describe critical operations that occur during part production			I	✓	✓
Describe non-critical operations that occur during part production			I	✓	✓
Describe tie-in operations that occur during part production			I	✓	✓
Describe allied operations that occur during part production			I	✓	✓
Describe inspection operations that occur during part production			I	✓	✓
Apply the rules determining the sequence of operations for punching			I	✓	✓
Apply the rules determining the sequence of operations for slotting			I	✓	✓
Apply the rules determining the sequence of operations for perforating			I	✓	✓
Apply the rules determining the sequence of operations for trimming			I	✓	✓
Apply the rules determining the sequence of operations for flanging			I	✓	✓
Apply the rules determining the sequence of operations for hemming			I	✓	✓

Unit: Basic Diemaking (Cont'd.)	10	12	AD	LL	WS
Competency: Describe sheet metal processing (Cont'd.)	▨	▨	I	✓	✓
Apply the rules determining the sequence of operations for bending			I	✓	✓
Recognize location, clamp, and support symbols			I	✓	✓
Explain proper locator positions for specified geometric shapes			I	✓	✓
Define "tolerance stacking"			I	✓	✓
Identify the characteristics of a cutoff die			I	✓	✓
Identify the characteristics of a drop through die			I	✓	✓
Identify the characteristics of a return type die			I	✓	✓
Identify the characteristics of a compound die			I	✓	✓
Identify the characteristics of a transfer die			I	✓	✓
Identify the characteristics of a combination die			I	✓	✓
Identify the characteristics of a continental die			I	✓	✓
Identify the characteristics of a subpress die			I	✓	✓
Identify the characteristics of a progressive die			I	✓	✓
Identify the characteristics of a shuttle die			I	✓	✓
Competency: Describe panel die development	▨	▨	I	✓	✓
Competency Builders:					
Describe styling plaster and details utilized in panel die development as to construction and function			I	✓	✓
Describe trim ledge and details utilized in panel die development as to construction and function			I	✓	✓
Describe draw beads and details utilized in panel die development as to construction and function			I	✓	✓

Unit: Basic Diemaking (Cont'd.)	10	12	AD	LL	WS
Competency: Describe panel die development (Cont'd.)	▨	▨	I	✓	✓
Describe upper binder and details utilized in panel die development as to construction and function			I	✓	✓
Describe rubber skin and details utilized in panel die development as to construction and function			I	✓	✓
Describe draw bars and details utilized in panel die development as to construction and function			I	✓	✓
Describe equalizing blocks and details utilized in panel die development as to construction and function			I	✓	✓
Describe lower binder and details utilized in panel die development as to construction and function			I	✓	✓
Describe tipping as a means of eliminating differential metal flow			I	✓	✓
List five advantages of an experimental die			I	✓	✓
Describe the steps and methods utilized to check draw development			I	✓	✓

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Unit: Basic Moldmaking	10	12	AD	LL	WS
Competency: Describe special considerations in mold making knowledge			C		
Competency Builders:					
Define a mold and the major parts of a mold			C		
Describe sand molding			C		
Describe compression molding			C		
Describe injection molding			C		
Describe blow molding			C		
Describe shoot molding			C		
Describe rim molding			C		
Describe vacuum molding and thermoforming			C		
Describe common materials that are molded: plastics, glass, rubber, aluminum, and powder metals			C		
Competency: Examine plastic blow molding			C		
Competency Builders:					
Describe plastic blow molding processes			C		
Describe plastic blow molding construction			C		
Describe special considerations in plastic blow molding			C		
Describe materials used for plastic molding process			C		
Competency: Examine glass blow molding			C		
Competency Builders:					
Describe glass blow molding processes			C		
Describe glass blow molding construction			C		
Describe special considerations in glass blow molding			C		
Describe materials used for glass molding process			C		

Unit: Basic Moldmaking (Cont'd.)	10	12	AD	LL	WS
Competency: Examine rubber molding	▨	▨	C	▨	▨
Competency Builders:					
Describe rubber molding processes			C		
Describe rubber mold construction			C		
Describe special considerations in rubber molding			C		
Describe materials used for rubber molding process			C		
Competency: Examine compression molding of thermoset plastics	▨	▨	C	▨	▨
Competency Builders:					
Describe the processes and parameters of each			C		
Describe types of mold construction			C		
Describe special considerations for compression molding of thermoset plastics			C		
Describe types of materials used for compression molding of thermoset plastics			C		
Competency: Examine transfer molding of thermosets	▨	▨	C	▨	▨
Competency Builders:					
Describe the processes of transfer molding of thermosets			C		
Describe different mold constructions			C		
Describe special considerations of transfer molding of thermosets			C		
Describe types of materials used for transfer molding of thermosets			C		
Competency: Examine injection molding of common materials	▨	▨	C	▨	▨
Competency Builders:					
Describe injection molding processes for different materials			C		
Describe injection mold construction			C		
Describe special considerations in injection molding			C		

Unit: Basic Moldmaking (Cont'd.)	10	12	AD	LL	WS
Competency: Examine molds for die casting			C		
Competency Builders:					
Describe die cast molding processes			C		
Describe die cast mold constructions			C		
Describe special considerations in die cast molding			C		
Describe types of materials used for die castings			C		
Competency: Examine the use of standard components (vendor items)			C		
Competency Builders:			C		
Describe the standard components available			C		
Describe the advantages and disadvantages of using standard components			C		
Describe procedures in selecting materials			C		
Competency: Examine cavities and their productions			C		
Competency Builders:					
Define a mold cavity			C		
Describe materials used for mold cavities			C		
Describe methods used to produce cavities and the designing of cavities			C		
Describe the advantages and disadvantages of each method			C		
Competency: Examine mechanical and hydraulic mold actions			C		
Competency Builders:					
Describe ejector systems and their components			C		
Describe slide cores and their use			C		
Describe systems for molding threads			C		
Describe molding inserts			C		

Unit: Basic Moldmaking (Cont'd.)	10	12	AD	LL	WS
Competency: Examine runners, gates, and vents	▨	▨	C	▨	▨
Competency Builders:					
Describe the purpose and construction of runners			C		
Describe the purpose and construction of gates			C		
Describe the purpose and construction of vents			C		
Describe advantages and disadvantages of each			C		
Competency: Examine cooling and heating systems for molds	▨	▨	C	▨	▨
Competency Builders:					
Describe the importance of temperature control in molding			C		
Describe cooling systems for molds			C		
Describe heating systems for molds			C		
Competency: Examine cavity and core surfaces	▨	▨	C	▨	▨
Competency Builders:					
Describe surface polishing techniques			C		
Describe surface coatings and their purpose			C		
Describe surface treatments and their purpose			C		
Describe surface texturing			C		
Competency: Examine materials used in the construction of molds	▨	▨	C	▨	▨
Competency Builders:					
Describe common materials used in the construction of molds			C		
Describe advantages and disadvantages of each			C		
Competency: Examine common mold problems and solutions	▨	▨	C	▨	▨
Competency Builders:					
Describe common problems with molds			C		

Unit: Basic Moldmaking (Cont'd.)	10	12	AD	LL	WS
Competency: Examine common mold problems and solutions (Cont'd.)			C		
Describe solutions for and prevention of these problems			C		
Competency: Examine repair of molds			C		
Competency Builders:					
Describe common defects in molds			C		
Describe the appropriate methods in the mold repair process			C		
Competency: Demonstrate knowledge of moldmaking terminology			C		
Competency Builders:					
Demonstrate knowledge of mold terms			C		
Demonstrate knowledge of moldmaking terms			C		

DH:05/01/95
JC:UPDATE 03/11/96